Geodyna

Optima

Service Manual

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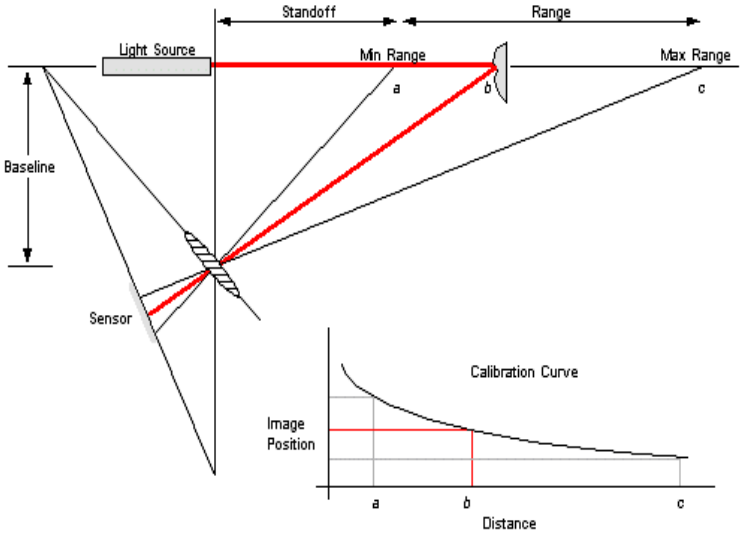
SERVICING THE OPTIMA

INTRODUCTION

The BFH/Optima Series system is a wheel balancing machine equipped with three optical scanners. Two scanners capture images of the wheel rim profiles (inner and outer), so that the co-ordinates of optimum positions for application of the balancing weights can be calculated automatically and without user inputs. The scanners are also used to obtain geometrical data about rim deformations, deviation of the rim edges from its axis of rotation (Rim Runout). The third scanner provides geometrical data about tire deformations, deviation of the tire from its axis of rotation (Tire Runout). Such data is used for advanced diagnosis of the wheel as well as to provide the user with indications on how to proceed in order to minimize the effects of such deformations.

THEORY OF OPERATION

The BFH/Optima Series system is based on distance measuring devices (range finders) based on the principle of LASER triangulation. This device comprises a LASER source, a lens and a linear optical image sensor (a CCD – charge coupled device). The beam of coherent light emitted by the LASER source hits the object whose distance is to be measured. The beam of light is diffused (scattered) in a plurality of light rays from the surface of the object and the rays are concentrated by the lens in a spot on the sensitive surface of the linear optical image sensor. The position of the spot on the sensor is determined by a digital analysis of the electrical signal produced by the sensor.



The distance between the object and the LASER source may be calculated. In practice, a calibration procedure is performed and a polynomial interpolation of a suitable degree is used. Specifically, the BFH/Optima system implements cubic spline interpolation with shape preserving characteristics.

The complete process is as follows:

1. Laser power – exposure time settling. The system is able to set the optimum values of laser power and CCD exposure time according to the ambient light, amount of reflected light, and reflectivity of objects.
2. Background subtraction. Two successive readings are taken: in the first the laser source is off, in the second is on. Complete sensor readouts are kept in the computer's memory. The difference of the acquired data provide an image of the CCD sensor without effects due to ambient light.
3. Detecting the position of the light peak on the linear optical image sensor.
4. Calculating the distance to the object by means of polynomial interpolation.

Profiling

In the BFH/Optima Series system, the distance measuring devices (range finders) are rotated in a plurality of known positions by a stepper motor, so that they constitute optical scanners. The scanners, detecting the distances from a known position of a plurality of points on the object to be explored (the wheel rim) allows the spatial co-ordinates of each point detected to be obtained.

For each scanner, the complete process is as follows:

1. Measuring the distance to the point hit.
2. Saving the distance measured at point 1 and the position of the distance measuring device at point 1.
3. Moving the laser range finder to the next known position.
4. Repeating steps 1 – 4 until the scan is complete.

Based on these co-ordinates, it is possible to identify positions on the rim profile which are useful, and even in a certain sense optimum, for the application of balancing counterweights. The co-ordinates of these positions are calculated automatically and without contact.

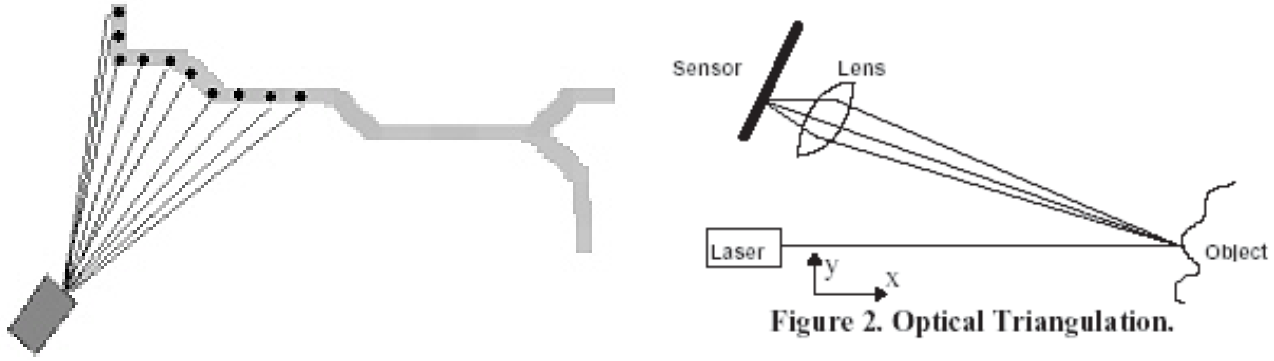


Figure 2. Optical Triangulation.

The complete weight position detection process is as follows:

1. Scan rim contour to determine typical rim parameters
2. Compare current rim pattern with a set of stored rim patterns
3. Select the best match stored rim pattern
4. Pick pre-established weight locations associated with the best match pre-established rim pattern
5. Calculate weight amount and display
6. Allow the user to modify suggested weight location by moving the laser pointer
7. “Learn” from experience

Rim Runout Measurement - Rim- Tire Matching / Optimization

It is known that the vibrations produced by a motor vehicle wheel as it turns are caused, by the following:

1. Uneven distribution of weights on the tire
2. Uneven distribution of weights on the rim
3. Geometrical deformation of the tire
4. Geometrical deformation of the rim
5. Uneven tire elasticity (variation in stiffness)

The BFH/Optima system allows the identification of geometrical deformations in the rim, that is to say, deviation of the rim axis from its axis of rotation:

Radial and Lateral Runout.
The scanner devices are rotated to a known position so that the LASER beam hits the surface of the rim at a predetermined point. The rim is rotated about the wheel balancer shaft and a plurality of distance measurements are taken at known rim angles of rotation. The operation is repeated for at least one other known distance measuring device position. On the basis of the data gathered in this way, a calculation process defines the eccentricity (Radial Runout) and angle (Lateral Runout) of the rim axis relative to the axis of rotation. This data can be used to provide the user an indication of the quality of the rim examined. It is also used to provide the user with indications on how to position the tire relative to the rim in order minimize the effects of such deformations.

In fact, the system allows the measurement of geometrical data relative to tire deformations, deviation of the tire axis from its axis of rotation. The distance measuring device is moved by rotation and translation to a known position so that the LASER beam hits the surface of the tire at a predetermined point. The wheel is rotated about the wheel balancer axis and a plurality of distance measurements are taken at known wheel angles of rotation. On the basis of the data gathered in this way, a calculation process defines the eccentricity – Radial Runout – of the wheel axis relative to the axis of rotation. A calculation process defines the eccentricity of the tire only, based on the measurements taken respectively on the rim and on the entire wheel by means of vector subtraction.

This data, together with the data about the imbalance and the data about the rim geometrical deformations, allows a complete wheel diagnosis and provides the user with more accurate indications. Moreover, a suitable optimization algorithm provides indications on how to position the tire relative to the rim in order to minimize the concurrent effects of such deformations in accordance with appropriate criteria. Typically, the tire is rotated with respect to the rim opposing the peak (maximum) of the
tire radial runout with the minimum of the rim radial runout, thus minimizing the radial runout of the assembled wheel.

BFH/OPTIMA SERIES MAJOR COMPONENTS

This section identifies the major components for the BFH/Optima Series balancer. All descriptions and AC/DC theory of other components can be found in earlier chapters of this service manual.

CAMERA PROCESSOR BOARD

The Camera Processor board is the liason between the three Scanner / CCD assemblies and the Main Processor PCB inside the Ebox.

J6/7/8/9

Pin #	Direction	Name	Description
1	Digital Out	Q3	Stepper Motor Phase B
2,5	Power Out	Un	Common Power Supply
3	Digital Out	Q4	Stepper Motor Phase D
4	Digital Out	Q2	Stepper Motor Phase C
6	Digital Out	Q1	Stepper Motor Phase A

J10

Pin #	Direction	Name	Description
1	Power Out	+5Vdc	Digital Power Supply (5V)
2	Digital In	Zpos3	Motor 3 Zero Position
3,4			dGnd Digital Ground

J11

Pin #	Direction	Name	Description
1	Digital In	PH-A	Encoder Phase A
2,4			dGnd Digital Ground
3	Digital In	PH-B	Encoder Phase B

J12

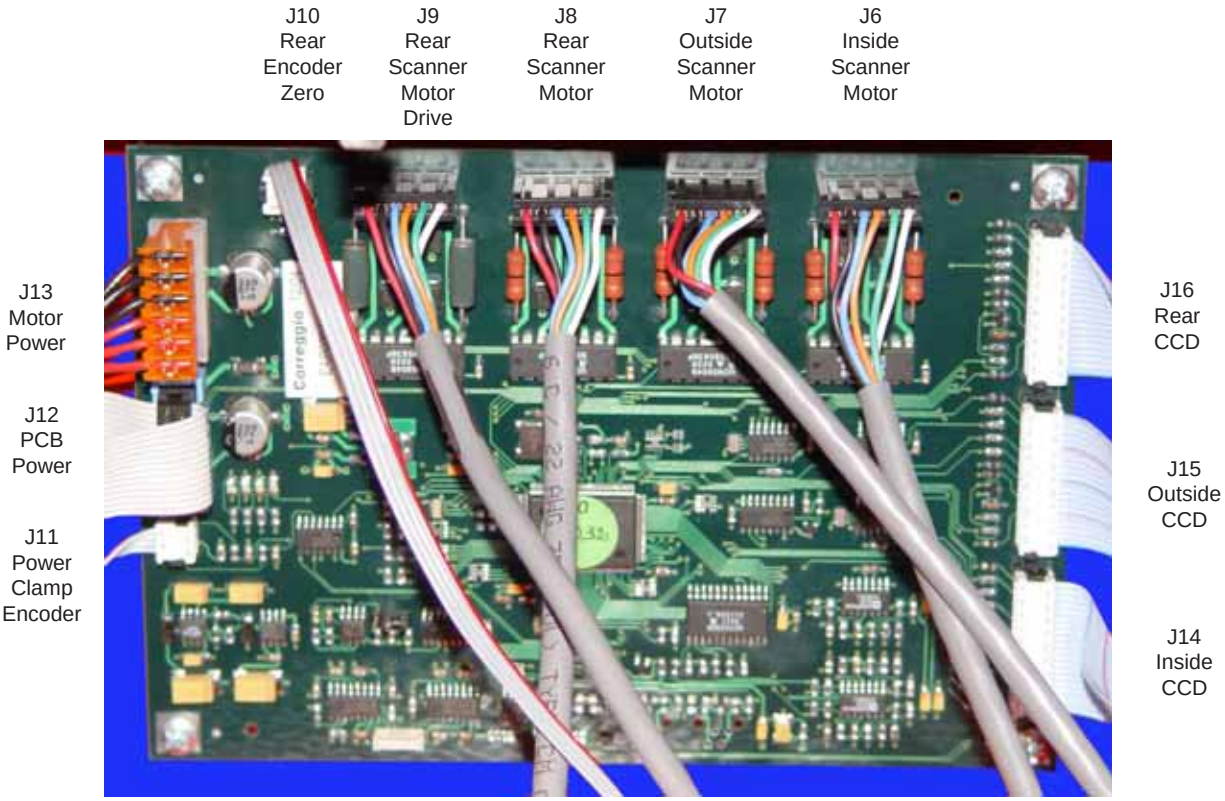
Pin #	Direction	Name	Description
1,2,4,6	Power In		External 5V power supply
3,5,13,14			External Ground
7,8,9,10		NC	Not Connected
11	Digital In	IIC-SCif	External IIC Serial Clock
12	Digital I/O	IIC-SDif	External IIC Serial Data

J13

Pin #	Direction	Name	Description
1,2,3	Power In		External Motor Power Supply
4,5,6			External Motor Ground

J14,15,16

Pin #	Direction	Name	Description
1,18,20			Digital Ground
2	Analog In	OSx	OS CCD signal
3	Analog In	DOSx	DOS CCD signal
4,12	Power Out	+5Vd	5V Digital Power Supply
5	Digital Out	FRMstx	Frame Start Signal
6	Out	LPx	Laser Pointer Switch
7	Digital Out	RSTx	Reset signal
8,10	Power Out	+3.3Vd	3.3V Digital power supply
9	Digital In	AUXoutx	Auxialiary Digital out
11	Digital In	CONVstx	Conversion start signal
13	Digital I/O	SDA	IIC serial data
14,16	Digital Out	E0/1	IIC EEPROM address configuration
15	Digital Out	SCL	IIC serial clock
17	Digital In	Zposx	Scanner home position signal
19	Digital Out	LASERx	Laser modulation signal



ELECTRONIC BOX

The BFH/Optima is equipped with an electronic box somewhat like the Y2k balancers. Additional components have been added to the power supply pcb to operate the “Power Clamp” and the “Power Clamp switch”. The box is backwards compatible but the older Ebox will not work in the BFH/Optima balancer.

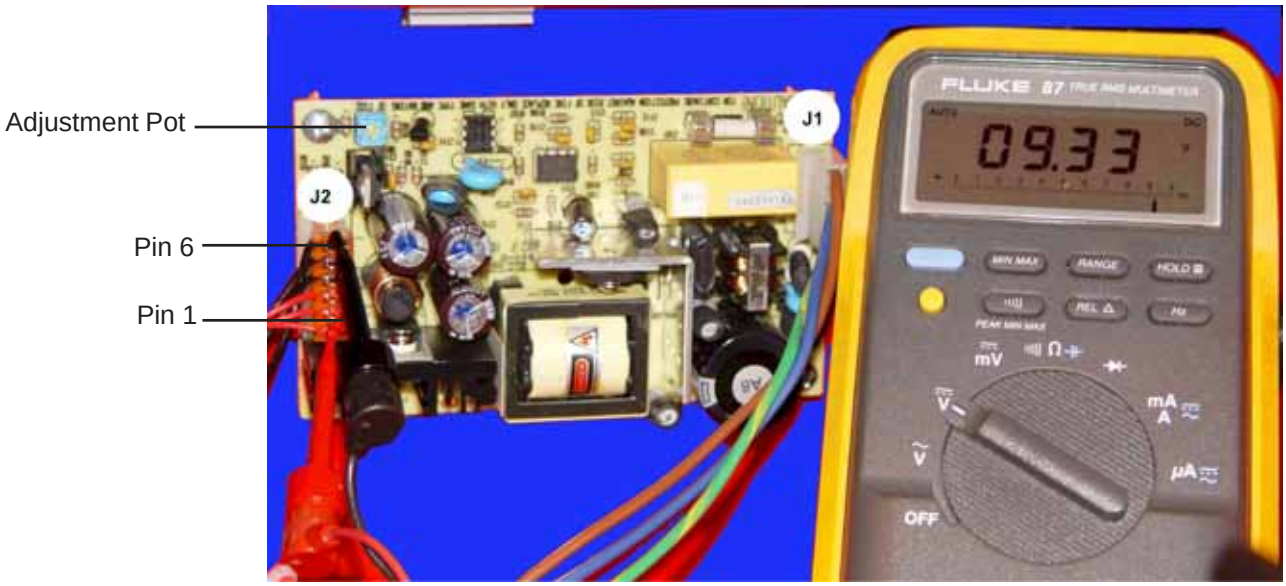
SCANNER / LASER / CCD

The BFH/Optima is equipped with 3 Scanner assemblies. Each of these assemblies are installed and calibrated as complete assemblies. A role call is performed with each one on boot up. ***There are no serviceable components on these assemblies with the exception of the manufactures mechanical adjustments. DO NOT ATTEMPT TO MAKE ADJUSTMENTS OTHER THAN THE ZERO REFERENCE STATED LATER IN THIS MANUAL.*** Each scanner assembly has a zero stop that has minor adjustment. The rear scanner assembly and the outside scanner assembly are identical and can be swapped. However, the inside scanner assembly has a different mounting bracket and cannot be interchanged with the other two assemblies. For troubleshooting purposes the units can be swapped at board level. Should any of these assemblies require replacement the balancer will flag an E360 error code and force a scanner calibration.

POWER SUPPLY PCB

The Power Supply PCB receives 230VAC power from the Electronic box. This voltage can be measured using a Digital Volt Meter at J1 pins 1 and 2 on the Power Supply PCB. The AC power passes through on-board bridge rectifiers converting the power to 9VDC which is used to power all of the (4) Scanner Motors. This 9VDC can be measured at J2 pins 1,2 and 3. Pins 4,5 and 6 are ground connections. This voltage must be adjusted after the installation of the Power Supply PCB. Follow the procedure below to measure and adjust the output voltage to the scanner motors.

1. Remove the weight tray
2. Place the positive lead of the Digital Volt Meter on Pin 1 (Red wire) and the negative lead of the Digital Volt Meter on Pin 6 (Black wire).
3. Use a small pocket screwdriver and adjust the pot to obtain a voltage reading between 9 - 9.5 VDC.

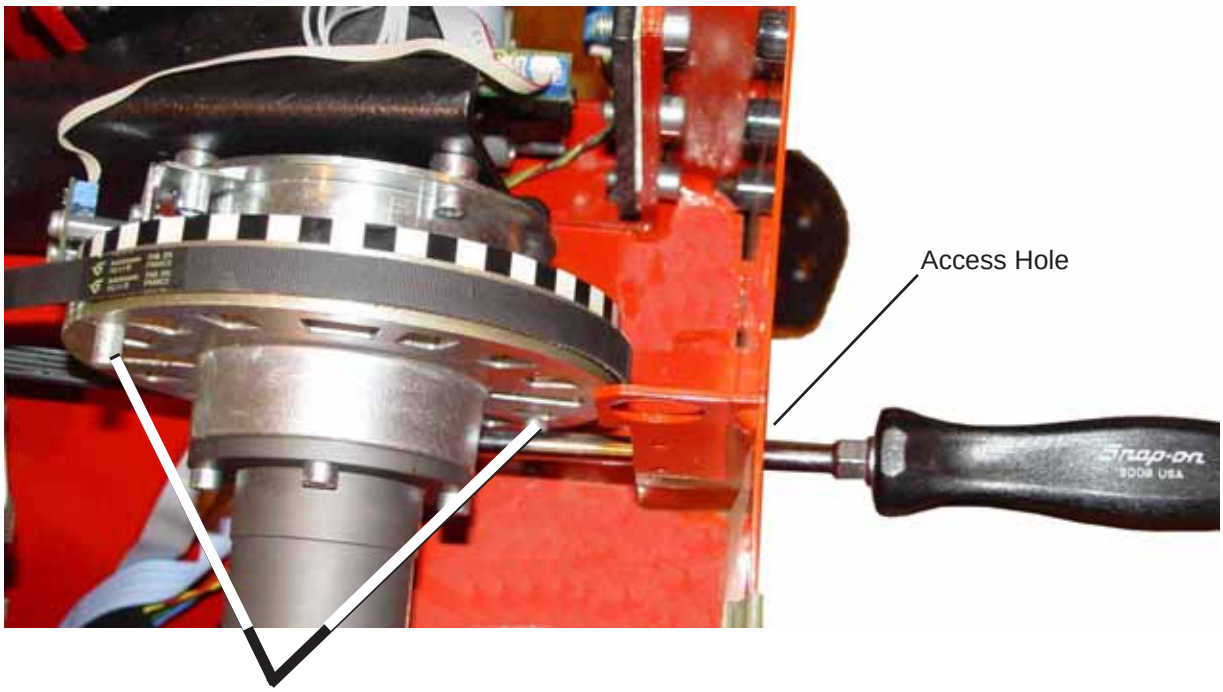


POWER CLAMP ASSEMBLY

The BFH/Optima series balancer is equipped with a power clamp that eliminates the need for a standard or quick clamp nut. The Power Clamp is activated by lifting up on the foot pedal mounted on the balancer. The vibratory system has an optical sensor mounted on the shaft that senses variation on a visible encoder disk. The opti switch looks to see if the shaft is spinning before operating the power clamp. The power clamp will not open or close if the shaft is spinning. The large pulley drives the power clamping jaws while the magnetic brake is engaged and is holding the shaft. Should the clamping jaws be engaged during the event of a power failure there is a manual overide to disengage the power clamp so the wheel/tire assembly can be removed.

Manual Overide Wheel and Tire Removal Procedure

1. On the front of the balancer, remove the plug from the access holes.
2. Insert a large screwdriver into the access hole approximately 6 inches.
3. Slowly turn the Wheel and Tire assembly CW until the “Manual Stops” make contact with the screw-driver.
4. Continue to turn the Wheel and Tire assembly until the power clamp cup reaches the end of the shaft.
5. Once power is resumed simply lift up on the foot pedal to re-engage the power clamp mechanism.



SELF TEST DURING START UP

The BFH/Optima performs a start-up routine when power is applied. A series of self diagnostic tests is conducted after the machine has been turned on. If a test is not successful: a series of audible signals is given, or an error code is displayed. A three-tone signal is given once, the machine is operative. In case there is a functional error, it must be acknowledged by pressing the STOP or ESC key to proceed.

Listed below are the steps that the balancer performs along with possible “E Codes”, “C Codes”, or “H Codes that could occur. This is for informational purposes.

1. Communication between microcontroller and embedded PC (Blue screen)

Service Codes: No service code available

Communication between micro-controller and embedded PC is not OK (check connecting cable). This can also indicate a bad connection to the keyboard. Check cabling between embedded PC and processor or cable to switches on the front panel.

2. Check availability of keyboard (E 300)

Service Codes : No service code available

The microcontroller was not able to detect a keyboard. Check cabling between microcontroller and keyboard.

3. Check content of permanent memories (E 145)

Service Codes: C85, C86 to copy content of permanent memory

Contents of both permanent memories are different, but both contain valid data. If the trouble signalled by the error code is not remedied (using service codes C85 or C86), the machine will remain in service code mode. It will be necessary to perform a manufatures calibration (C83, C84, C88)

4. Check model information (E 900)

Service Codes : C47 to set model

The stored machine model is not known. If the trouble signalled by the error code is not remedied (using service codes C47), the machine will remain in service code mode.

5. Check keyboard (E 89)

Service Codes : No service code available

One of the keys F1 to F6, HELP, ESC, START supplies a key code. The machine will proceed with the next step only if the trouble is remedied.

6. Check pedal switches (E 89)

Service Codes : C56 to check the pedal switches.
C75, AdC16 to check voltage to external switches. (See “C75”)

One or, if available, both pedal switches are actuated. The user can now remedy the trouble. Press STOP or ESC key to check the pedal switch once again and to delete the error code reading. If the trouble cannot be remedied, the pedal is made inoperative.

7. Check BFH/Optima **Calibration (E 360)**

Service Codes : All codes available for this model

The BFH/Optima hardware requires wheel profiler position calibration.

When the camera controller board is replaced on the machine, the software detected that calibration data is missing.

Calibration procedure C122 is required to calibrate the actual position of the laser scanners with respect to the balancer reference plane.

8. Check BFH/Optima **Hardware (E 361)**

Service Codes: All codes available for this model

Wheel profiler is not present or responding during the self test. The balancer controller board was not able to communicate with the camera controller board during start-up test.

Possible causes:

- •The camera controller board is missing or dead.
- •The cable connecting the balancer controller board and the camera controller board is un plugged, damaged or missing.

9. Check BFH/Optima **Hardware (E 362)**

Service Codes : All codes available for this model

Main camera board self test failed.

Balancing is not possible since wheel data cannot be scanned.

Problem during power up. Switch power off and on again. Possible camera board failure.

10. Check BFH/Optima **Inner Scanner (E 363)**

Service Codes : All codes available for this model

Left side scanner self test failed or CCD not calibrated or zero mark not detected.

Balancing is not possible since wheel data cannot be scanned.

11. Check BFH/Optima **Outer Scanner (E 364)**

Service Codes : All codes available for this model

Right side scanner self test failed or CCD not calibrated or zero mark not detected.

Balancing is not possible since wheel data cannot be scanned.

12. Check BFH/Optima **Rear Scanner (E 365) (Excluding 800)**

Service Codes : All codes available for this model

Rear scanner self test failed or CCD not calibrated or zero mark not detected.

Wheel data can be scanned, balancing is possible. Runout measurement of the wheel is not possible.

13. Hardware tests C1- --- -

If an error occurs during the hardware test. The four hyphens replace the digits 0 to 9 and the letters A to F which all characterize an error/defect. **Refer to all Error Codes in Appendix A**

The following test are performed:

A. Power supply voltage (235V)
B. 5V line
C. Incremental encoder (Current of optoelectronic LED)
D. Transducer signal available
E. Auto Stop System (Voltage for relay on Motor Control Board)

A. Hardware test - common errors

C10F02 - Test returned with an error. No valid test results available
C10F07- Test function reported an unkown error
C10F18- Test timed out. No valid test results available

B. Hardware test - Power supply voltage

C10800
C10801
C10804

Service Codes: C55 to check line voltage.

If the line voltage is below or above a limit the error code is displayed. (See “C55”)

C. Hardware test - 5V line
C10810
C10811
Service Codes: C110 to check 5V voltage.
If the 5V voltage is below or above a limit the error code is displayed.

D. Hardware test - Current of optoelectronic LED
C10705
C10706
C10707
C10708
Service Codes: C75, AdC1 to check LED
If the current / voltage is below or above a limit the error code is displayed.

E. Hardware test - Transducer signals
C10410
C10420
C10430
Service Codes: C103/C104 to check transimpedance and signal amplifiers and transducer values.
If no signals from the transducers are detected the error code is displayed.

F. Hardware test - Auto stop system
C10380
C10381
C10382
C10383
Service Codes: C75, Adc21 to check voltage on capacitor of the auto stop system.
If the voltage is below or above a limit or the recharging time is above a limit the error code is displayed.

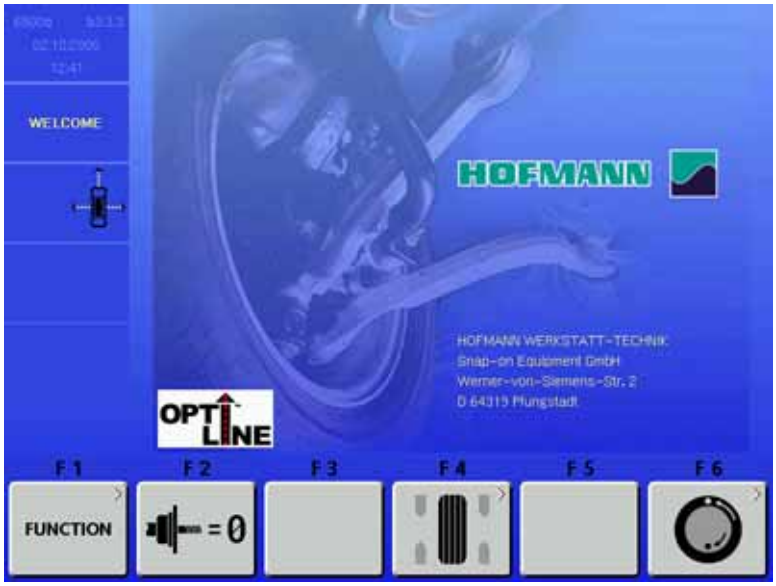
14. Hardware test disturbed H 82

Service Codes : All codes available for the model
A self test was disturbed (e.g. wheel was rotated during the transducer test)
The code is displayed for 3 seconds, then measurement is repeated (10 times maximum), or aborted using the STOP or ESC key.

15. Power clamp service interval expired E93

All codes available for this model.

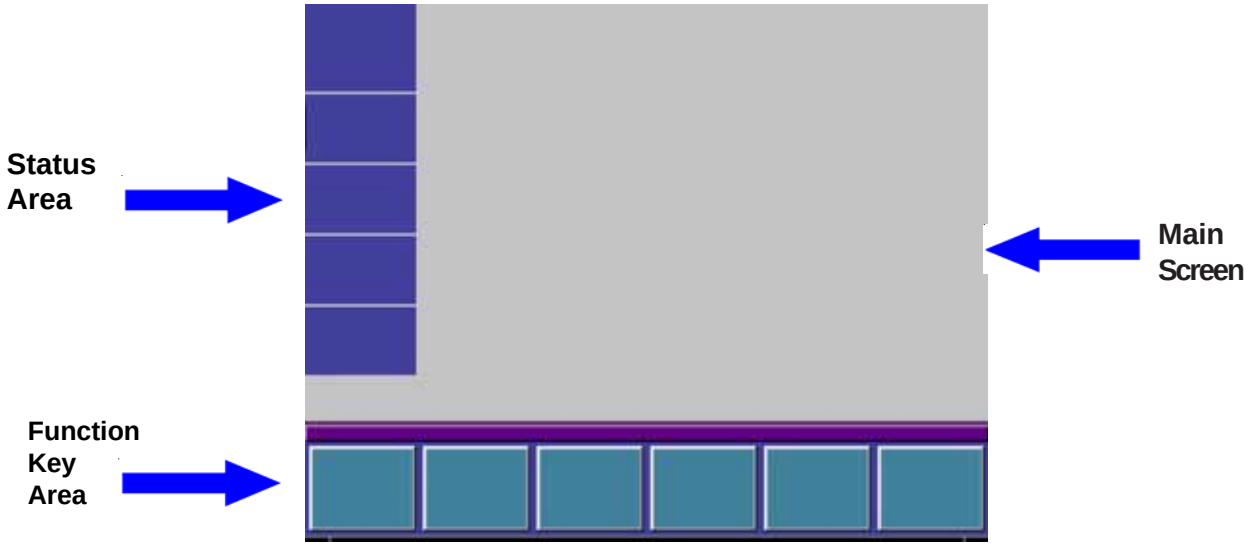
After a successful boot up the following screen will appear on the display.



DISPLAY DESCRIPTION

The Display of the BFH/Optima Series balancer is divided into three parts. Each of these parts display different information throughout the use of the balancer.

- **Main Screen**: Main information screen for the user interface.
- **Function Key area:** Six function keys F1 to F6, the functionality of the keys can change in every screen. Represents the function of the keys on the keyboard.
- **Status Area:** Status information from top to bottom, balancer model and software revision, date and time, screen name, balancer status (i.e. adapter compensation active, loaded user), error messages.



BALANCER SETUP

On the initial installation the balancer should be setup for the customer preferences i.e. ounce/gram, day/month/year, time, etc. Press the "***Function***" key (F1)

Start = No Function
Stop = Stop the Main Shaft
Escape = No Function
Help = Go to Help Screen

F1 = Go to Function Screen / Enter Service Mode User Calibration / Text Editor
F2 = Adapter compensation function or if adapter compensation is active; switch off. The unbalance of an adapter can be temporarily compensated with this function. If the adapter compensation is active it is indicated by the adapter compensation icon in the status area. (Operator Manual)
F3 = No Function
F4 = Go to Balancing Function (Operator Manual)
F5 = No Function
F6 = Optima menu (Operator Manual)

FUNCTION SCREEN

Start = No Function
Stop = Stop the Main Shaft
Escape = Back to Introduction Screen
Help = Go to Help Screen

F1 = User Calibration
F2 = Go to text editor
F3 = No Function
F4 = No Function
F5 = Used to toggle selected Function
F6 = Used to change selected Function

While pressing and holding in the **<F6>** key rotate the shaft. The green indicator arrows in the "Main Screen" area will either move up or down depending on the direction of the shaft rotation. Once the indicating arrow reaches the function to be changed release the "F6" key. Press and hold the **<F5>** key to toggle the function. The indicator arrow at the bottom of the "Main Screen" area indicates additional information. The two "--" marks at the top of the Main Screen area indicates that there is no information above the selected function.

FUNCTION DESCRIPTION

Balancer operating mode.
Saving the operating mode setting in the non volatile memory. The saved setting are now active after the next power on.

- 0: manual (The BFH/Optima must be set to the manual mode before running any C-Codes.)
- 1: profiling
- 2: optima

Setting factory default modes of operation.

- Set to 1 for changing all setting to factory defaults and settings.

Saving modes of operation in permanent memory.
Saving the user settings in the non volatile memory. The saved setting are now active after the next power on.

- 0: do not save
- 1: save settings

After successful write to the non volatile memory the display board speaker sounds the typical Snap-on "TüDüLü".

Language selection.

- The English Language is the first one on the list.

The volume of audible signals.

- 0 ... 100: selectable from 0 (off) to 100 (loud), 50 is default.

Resolution of unbalance amount readings.
The resolution of the unbalance display.

- Normal: rough, default 5 gram / .25 ounces
- Fine: fine 1 gram / .05 ounces

Suppression of minor unbalance readings.
The user threshold can be changed with C8. Below this threshold the unbalance value is set to zero.

- off
- on, default

Setting threshold value for unbalance suppression.
Threshold value for suppression of minor unbalance readings.

- 3.5 ... 20.0 grams, 3.5 grams is default
- 0.25 ... 2.00 ounces, 0.25 ounces is default

All unbalance values below the threshold are set to zero if suppression of minor unbalances is enabled. If the right, left and static unbalance values are set to zero the OK segment is on. If the ALU mode is not normal the unbalance values are transformed to the normal ALU mode to check the values.

Measurement units of the unbalance amount readings.

- grams, default
- ounces

Number of revolutions for a measurement run.
Note that a decrease of the number of revolutions for a measurement run can cause an in-accuracy of the measurement results.

- 5 ... 25: Number of revolutions for a measurement run, 10 is default.

Starting a measuring run by closing the wheel guard.
This feature does not work in the user codes, service codes, optimization and minimization.

- off, default
- on

Automatic braking when wheel guard is raised.

- off: no automatic braking, motor is switched off.
- on: braking to standstill, default.

Releasing of the power clamping device.
The power clamp system can be locked. This can be used if a special clamping device is in use.

- off: no lock, default
- on: locked

Actuation direction of pedal for clamping/releasing.
The functionality of the power clamp foot pedal can be changed.

- raise: raise pedal for clamping, default
- press: press pedal for clamping

T**hree lines for changing the date.**

- Day: dd.—.—
- Month: —.mm.—
- Year: —.—.yy

Two lines for changing the time.

- Hour: hh:—
- Minute: —:mm

The balancer has counters to count the measured runs.
The counters are displayed in three lines:

- number of measurement runs / number of measurement runs with OK
- number of measurement runs since last calibration / number of clamping.
- number of optimization and minimization / number of measurement runs in service mode

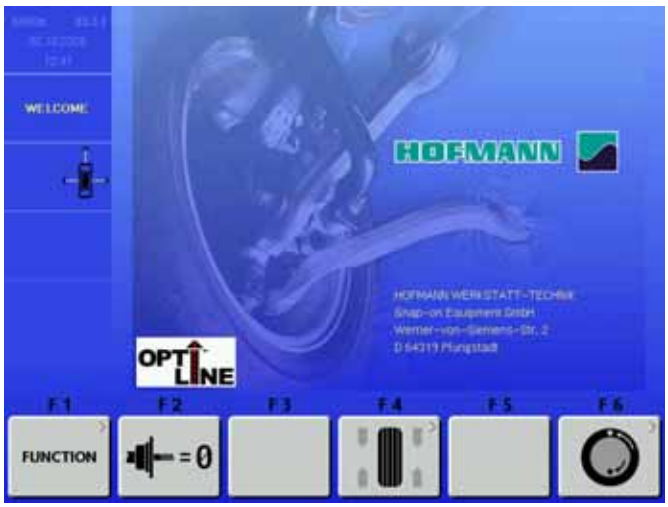
Screensaver timeout (0=disable)

- Amount of time for screensaver to activate while unit is sitting idle (default 20)

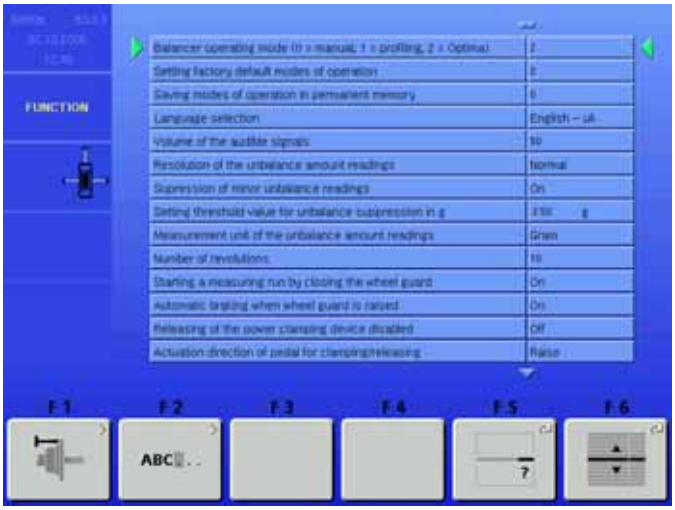
CUSTOMER CALIBRATION

The BFH/Optima balancer features a simple user calibration program. Perform this procedure when the balancer has been moved, disturbed, or whenever accuracy is questioned. Occasional field calibration will ensure years of reliable service.

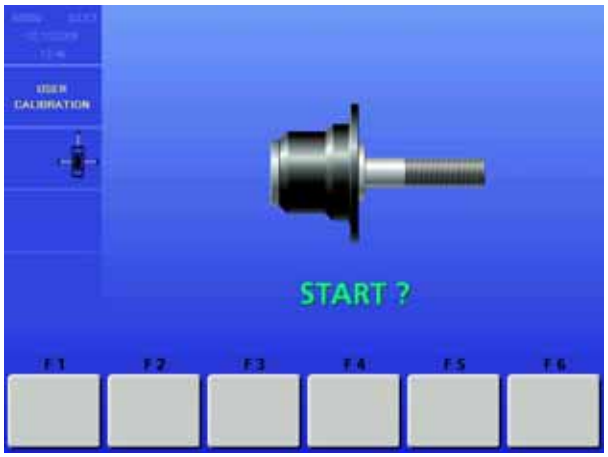
1. Press and release the ***<Function>*** key (F1) from the “Intro Screen”.



2. Press and release the ***<Calibration>*** key (F1).



3. With nothing mounted on the shaft lower the wheel guard and press the <***SPIN***> key. The balancer should spin and come to a complete stop.



4. After the balancer comes to a stop raise the wheel guard and screw the calibration slug into left side of the flange plate. Lower the wheel guard and press the <***SPIN>*** key. The balancer should spin and come to a complete stop. Once the shaft stops the display should display “OK” and the speaker sounds the Snap-on “TüDüLü”.

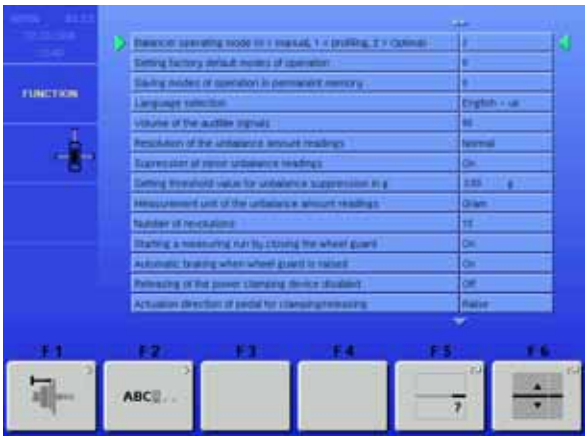
Calibration Complete

ENTERING SERVICE MODE

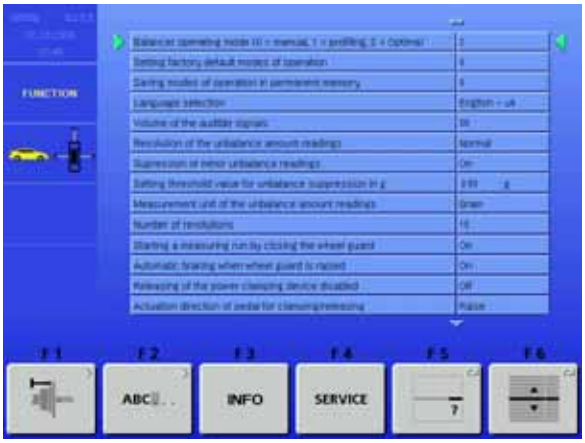
1. From the Introduction Screen press the <***FUNCTION***> key (F1) to enter in to the Function Menu.

2. By pressing the **<F6>** key 3 times successively the "***SERVICE***" key (F4) will become active.

NOTE: BEFORE PERFORMING ANY "C-CODES" ON THE BFH/OPTIMA BALANCER THE TECHNICIAN MUST FORCE THE BALANCER INTO THE MANUAL MODE. SEE "BALANCER OPERATING MODE" UNDER "FUNCTION DESCRIPTION EARLIER IN THIS CHAPTER.



3. By pressing the **<F4>** key the service program will become active.



C CODES

By pressing and holding the <***C-CODE>*** key (F1) and rotating the main shaft the user can select the desired C-Code. Once the desired C-Code is displayed in the C-Code identifier window the technician needs to simply release the "***C-Code***" key (F1). After each C-Code change it is recommended that the technician save the change by use of the "***C90***" code. Many codes are written for engineering purposes and are not valid for field use.

C	Description
28	Display and clear error codes
43	Reset counters
47	Select machine model
55	Indication of the line voltage
56	Indication of the circuit state of the wheel guard switch
57	Indication of temperature
59	Indication of the residual unbalance compensated for using code C84
60	Motor: Indication of the RPM of main shaft
74	Indication of the position counter and basic incremental encoder test
75	Display values from AD converter
76	Indication of the voltages used by the 2 step motor control
80	Geodata arm adjustment and calibration (Hofmann Optima only)
81	Geodata arm calibration (Hofmann Optima only)
83	Calibration of the unbalance measurement with wheel/test rotor.
84	Compensation of unbalance of main shaft
85	Copy content of serial EEPROM (EEP) from micro-controller EEP to incremental encoder EEP.
86	Copy content of serial EEPROM (EEP) from incremental encoder EEP to micro-controller EEP.
88	Calibration of the 12 o'clock position for positioning the weights on the wheel.
90	**Saving the adjustments data**
98	Display angular position of power clamp pulley, incremental encoder test.
110	Indication of the operating voltages supplied by the power supply module.
120	Enable / Disable the laser pointer
122	Calibration of the Scanner / Laser / CCD assemblies (Inner, Outer and Rear).
123	Manufacturing diagnostic and mechanical adjustment test.

C28 DISPLAY AND CLEAR ERROR CODES

The last 10 different malfunction codes are written into the error memory so that they can be called up and reported by the operator of the wheel balancer e.g. for remote diagnosis of malfunctions. The most recent malfunction code is written into memory location 1 and the previous error codes are shifted to the higher memory locations. Displays the internal error code (6 digits).

NOTE: MAKE SPECIAL NOTE OF DIAGNOSTIC CODES THAT RELATE TO A SPECIFIC COMPONENT. REPEATED DIAGNOSTIC CODES POINT TO THE FAILED COMPONENT.

Use the "Enter" key (F4) to proceed to the next error message (reading Err1 -Err10). If no error occurred, "—" is displayed. Clearing the entire error memory (step 2): Press the Acknowledgment key to proceed to step 2. Use the option selection to choose "1" and acknowledge with the "Enter" key (F4).

C43 RESET COUNTERS

This C-Code is used to reset all balancer counters. The following counters are reset. This code will not clear any error codes that have been set into memory.

- Total number of measuring runs
- Number of measuring runs where balance quality was considered OK
- Number of optimizations and minimizations
- Number of measuring runs in service mode
- Number of measuring runs since the last calibration

0: No reset of counters
1: Reset of counters

C47 SELECT MACHINE MODEL

This balancer is sold world wide under different brands and model numbers. To validate any software upgrades. Enter C47, press the <F4> key followed by pressing the <F6> key, the balancer will reboot after a few seconds.

C55 INCOMING LINE VOLTAGE

Measured line voltage going into the electronic box. The correct voltage is 230VAC ± 10%.

C56 CIRCUIT STATE OF THE WHEEL GUARD

This test function can be used to determine the angle at which the wheel guard switch trips. With the wheel guard in the open (up) position the reading should be 000. Slowly lower the wheel guard to the closed (down) position, the reading will change once to 100 indicating the position of a closed wheel guard.

C57 VIBRATORY TEMPERATURE SENSOR

Measures the vibratory temperature, measurement displayed in Celcius.

C60 MOTOR RPM

Once this code is called up "---" is displayed in the right display. As soon as measured data is available, the current speed is displayed. The correct value is 190 ± 10 RPM.

C74 POSITION COUNTER AND BASIC INCREMENTAL SHAFT ENCODER TEST

Once this code is called up, the angular position and incremental encoder status register are display continuously. **For a short test turn the main shaft at least 2 turns in both directions, the status register then must show 23F.** For detailed status information see below.

Angular position:
As long as the incremental encoder has not yet synchronized with the zero reference, the angular location reading is "- - -". After synchronization the angular position is display as a value in a range between 0 and 511.

-00 after switching power on (main shaft not moved at all), or after pressing the Special function key
-07 after 2 turns backward → A- and B channel signals are OK, but there is no synchronisation in backward direction.
-0b after 2 turns forward → A and B channel signals are OK, but there is no synchronisation in forward direction.
-1b after 2 turns forward/ backward → A and B channel signals are OK, synchronisation in forward rotation is OK as well.
-1F after 2 turns in each direction A and B channel signals are OK, but synchronisation was made in forward direction only
-27 after 2 turns backward → A and B channel signals are OK, synchronisation in backward direction is OK as well
-2F after 2 turns in each direction → A and B channel signals are OK, but synchronisation was made in backward direction only.

23F Incremental encoder was rotated by more than 2 turns in each direction and performs properly.
>-40 Synchronisation error in forward direction
>-80 Synchronisation error in backward direction

Comments
If this test fails (**no 23F**) please check
- the cabling of the opto electronic – micro-controller
- the connectors of the cable
- clean the incremental encoder sleeve

C75 DISPLAY VALUES OF A/D CONVERTER

NOTE: SOME OF THESE CODES ARE NOT USED IN THE BFH/OPTIMA SOFTWARE.

AD input	Channel	Description	
AdC 0	0.0	REF-AD	Reference voltage of external AD converter
AdC 1	1.0	fLED-CW	LED current control
AdC 2	2.0	fSON-TMP	Temperature ultrasonic unit
AdC 3	3.0	fBAL-TMP	Temperature of transducer/vibratory system
AdC 4	4.0	fANA3	Motor current
AdC 5	5.0	fANA2	Power interface board multiplexer channel Y
AdC 6	6.0	fANA1	Power interface board multiplexer channel X
AdC 7	7.0	fPOT	free
AdC 8	8.0	fPOt-WHO	Width potentiometer (not used)
AdC 9	9.0	fPOT-OFS	Distance/extraction potentiometer (not used)
AdC 10	10.0	fPOT-DIA	Diameter/angle potentiometer (not used)
AdC 11	11.0	RF1V23	Internal reference voltage of analogue unit potentiometer
AdC 12	12.0	VCC-W	½ voltage of +5V supply
AdC 13	13.0	fLINE-V	Mains voltage control
AdC 14	14.0	AIR	Input of voltage amplifier in front unbalance channel
AdC 15	15.0	AIL	Input of voltage amplifier in rear unbalance channel
AdC 16	5.0	VCSSw*	0.793 * supply voltage to external switches
AdC 17	6.0		free
AdC 18	5.1	VBrCur*	Coil current of solenoid brake (not used)
AdC 19	6.1		free
AdC 20	5.2	VDisp*	Supply voltage of display board
AdC 21	6.2	VAssStat*	Voltage on capacitor of AutoStopSystem
AdC 22	5.3	VRimSens*	Identification of rim material (not used)
AdC23	6.3	VRelCur*	Coil current of relay
AdE 1	AE1		External AD converter (rear transducer)
AdE 2	AE2		External AD converter (front transducer)

* via multiplexer on the power interface

C80 GEODATA ARM ADJUSTMENT / CALBRATION

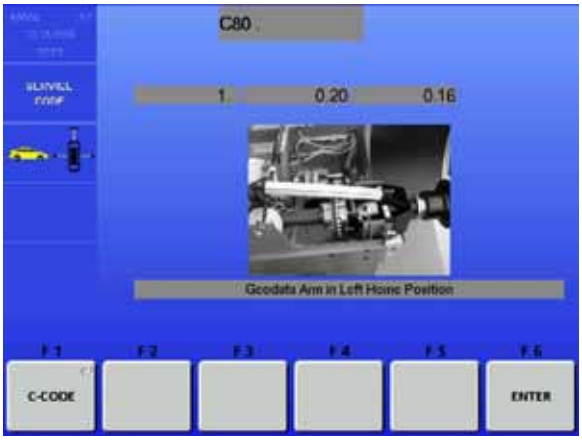
NOTE: THIS TEST REQUIRES THE USE OF A SPECIAL CALIBRAITON ROD AS SEEN IN STEP 5. FAILURE TO USE THE REQURIED TOOL WILL RESULT IN A CALIBRATION ERROR.

1. Enter the "***Service***" routine and select C80.

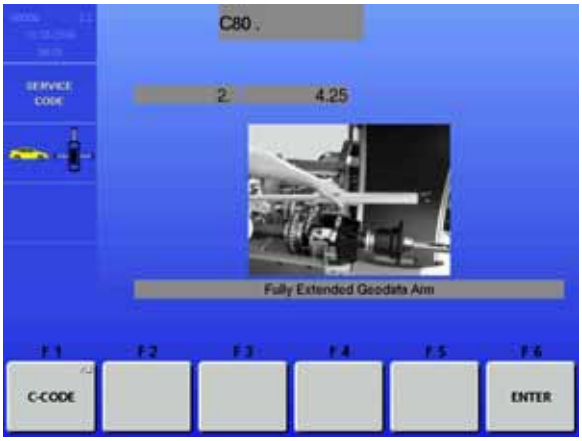
2. The basic settings of .15 to .20 Volt of the diameter and distance potentiometers are read out.

   The left-hand reading refers to the basic setting of the diameter potentiometer. Engage the calibration tip of the gauge head with the calibration groove in the board of the vibratory system. If the slider voltage of the diameter potentiometer is not within a range of .15 to .20 Volt, turn the potentiometer shaft to bring the voltage to within this range.

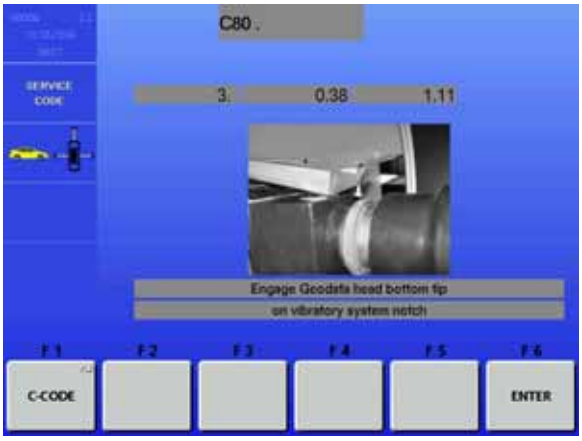
   The right-hand reading refers to the basic setting of the distance potentiometer.If the gauge arm is in left home position and if the slider voltage of the distance potentiometer is not within a range of .15 to .20 Volt, turn the potentiometer shaft to bring the voltage to within this range. Return the gauge arm into the left home position and press the **<F6> *"ENTER KEY"*** to store the values.



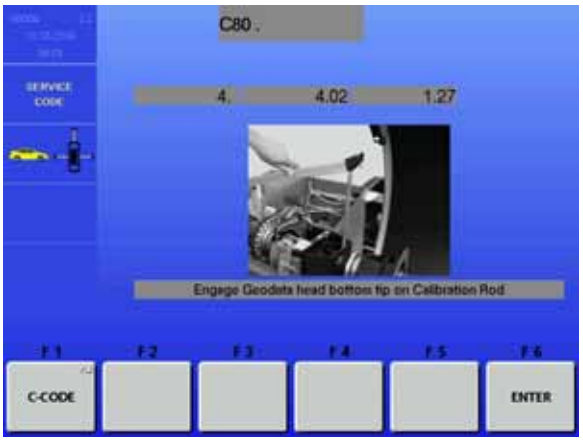
3. Fully extend the Geodata arm and hold, press the **<F6> *"ENTER KEY"*** to store the value.



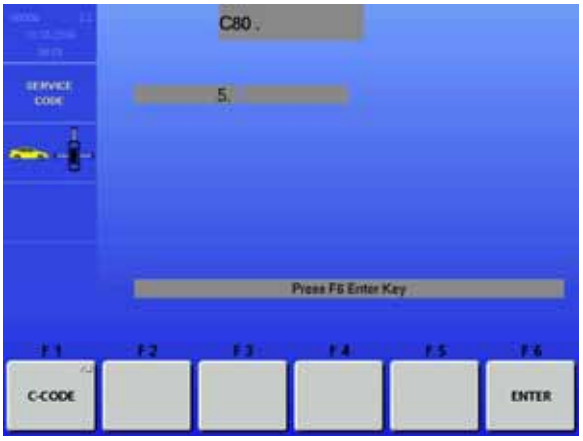
4. Engage the calibration tip on the bottom of the Geodata head with the calibration groove in the vibratory system and press the **<F6> *"ENTER KEY"*** to store the value.



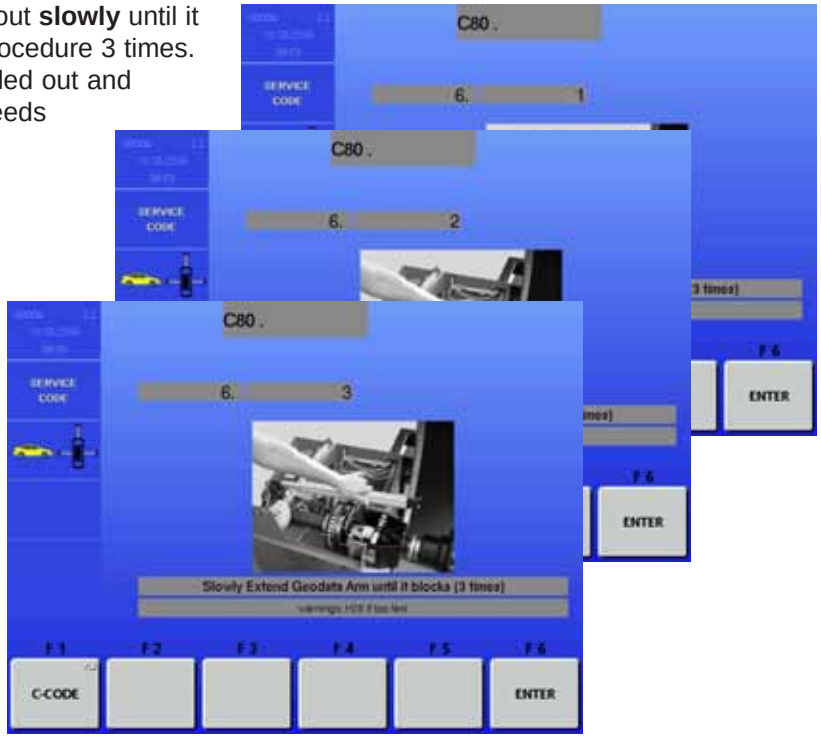
5. Raise the gauge arm, apply the calibration tip of the diameter calibration rod into the calibration groove of the board of the vibratory system and the calibration tip of the gauge arm into the recess at the lower end of the calibration rod. Pull out the gauge arm until the calibration rod is in vertical position. Press the ***F6 ENTER KEY*** to store the value.



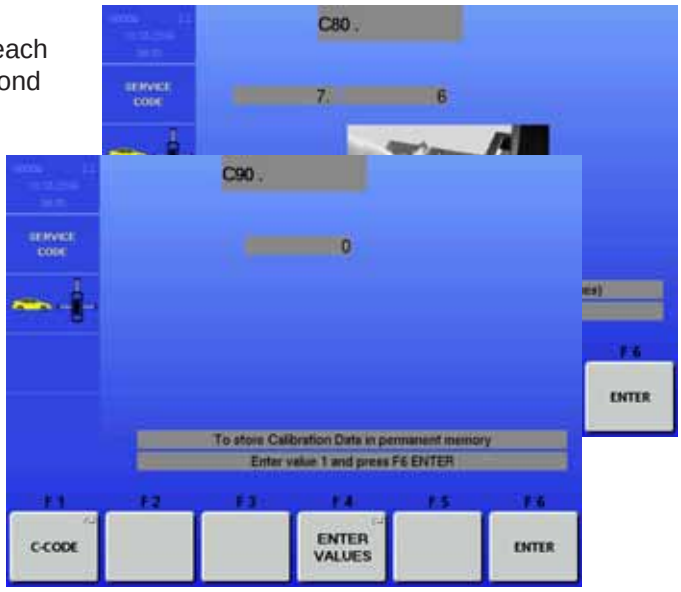
6. Step number 5 of the calibration is not programmed. Press **<F6> *"ENTER KEY"*** to continue.



7. Grasp the Geodata arm and pull it out **slowly** until it clamps and hold it. Repeat this procedure 3 times. When the gauge arm had been pulled out and clamped 3 times, the reading proceeds automatically to step 7.



8. Pull out the gauge arm at least 7 times with increased **constant speed** until it clamps. After each clamping hold the gauge arm for at least 1 second in the instantaneous clamping position before repeating this procedure. When the gauge arm had been pulled out and clamped 7 times, the reading proceeds automatically with C90 “Save Calibration Data”.

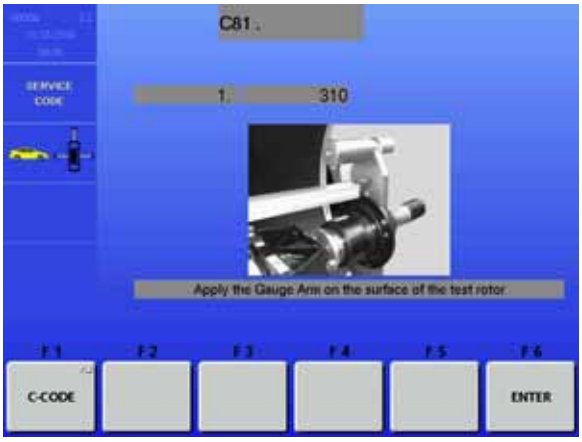


C81 MEASURING ADAPTER FLANGE AND ZERO PLANE

1. Enter the “***Service***” routine and select C81.

2. Mount the Pruefrotor on the shaft.

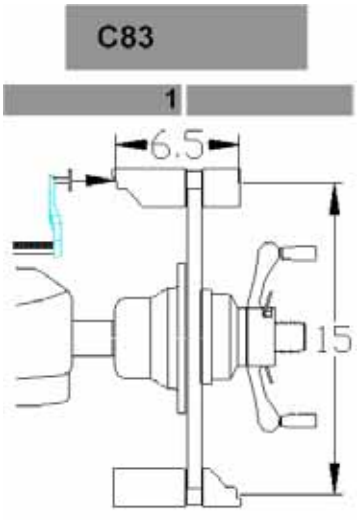
3. Pull the Geodata arm and touch the tip of the arm to the body of the Pruefrotor and press the **<F6>** ***“ENTER KEY”*** to store the value.



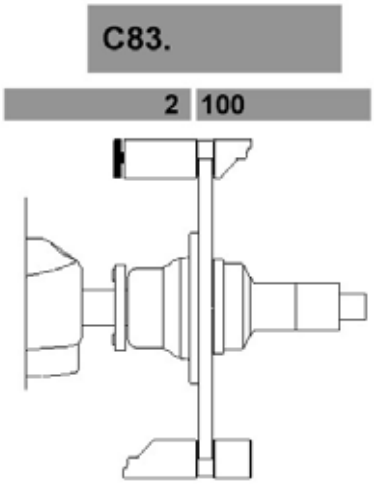
C83 CALIBRATION OF UNBALANCE MEASUREMENT

This test must be done using a Pruefrotor.

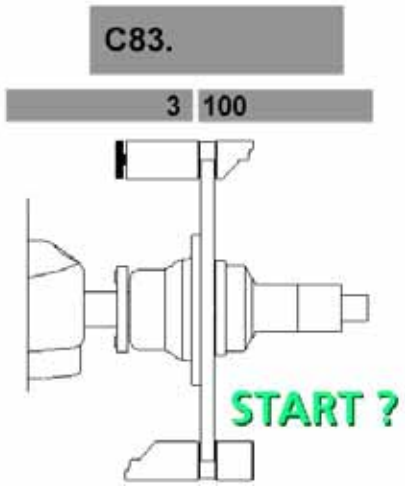
NOTE: THIS TEST REQUIRES THE USE OF A PRUEFROTOR. ALL TESTS MUST BE DONE WITH THE BALANCER IN THE MANUAL MODE. AFTER ALL TEST ARE DONE THE BALANCER MUST BE SWITCHED BACK INTO THE PREFERRED OPERATING MODE. ALSO CHECK THE VCC VOLTAGE "C110" AND ADJUST IF NECESSARY BEFORE ANY CALIBRATION IS DONE.



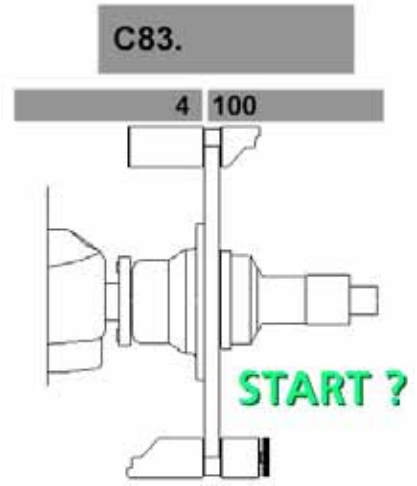
1. Mount the Pruefrotor on the balancer shaft and enter in the parameters of the Pruefrotor using the balance screen.
2. Enter the "***Service***" routine and select C83. Press the <***START>*** button to begin the measuring run.



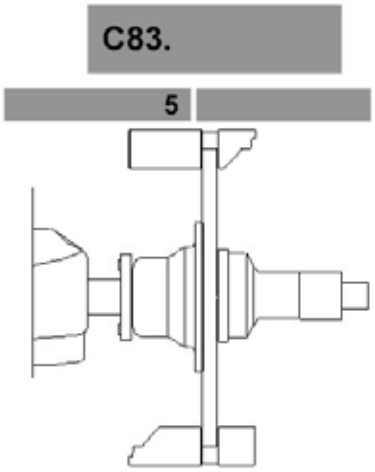
3. After the spin cycle completes, screw the 100 gram weight on the left side of the Pruefrotor and press the <***ENTER>*** key (F6) to enter the value of the test weight and to advance to step 3. Press the <***START***> button to begin the measuring run.



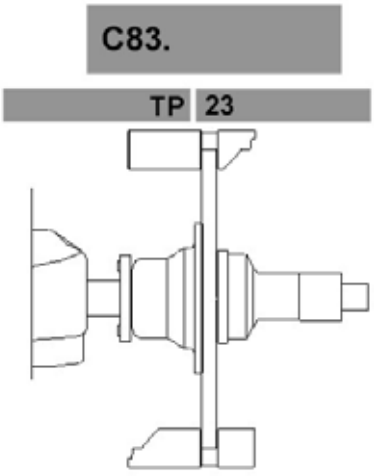
4. Remove the 100 gram calibration weight and insert it into the right hand plane of the Pruefrotor. Press the <***START***> key to begin the measuring run.



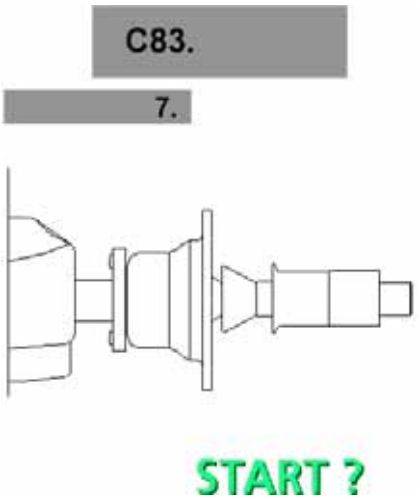
5. Step Number 5 has not been programmed. Press the <***ENTER***> key (**F6**) to advance to the next step.



6. The ambient transducer temperature is displayed for 1 second.



7. Remove the Pruefrotor. Install the small and medium cone on the shaft. Remove the pressure cup from clamping nut and clamp both cones on the shaft. Lower the hood and press the <***START***> button to begin a measuring run.

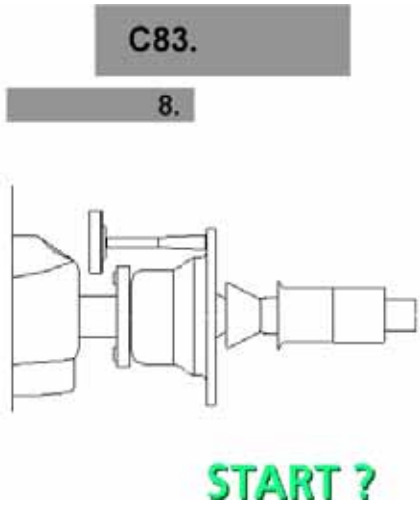


8. Insert the calibration weight that is supplied with the balancer on the left side of the backing plate. Press the <***START***> button to begin a measuring run.

9. Store the new factors using C90.

NOTE: MUST COMPLETE C84 AFTER THIS FUNCTION

CALIBRATION COMPLETE

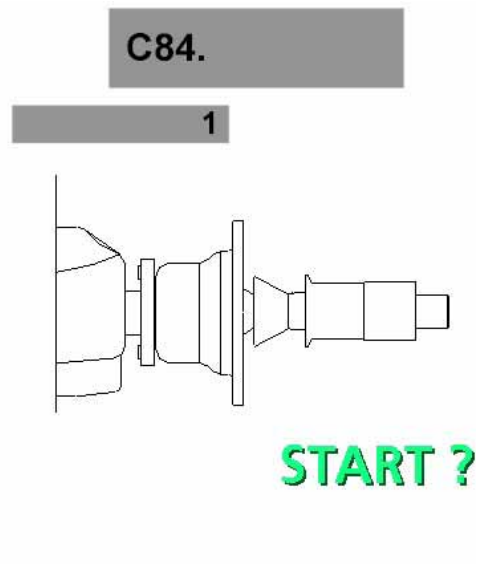


C84 EMPTY SHAFT COMPENSATION

NOTE: THIS PROCEDURE REQUIRES THE USE OF A SPECIAL CALIBRATION RING (EAM0033D53A). DO NOT ATTEMPT THIS PROCEDURE WITHOUT IT. THE BALANCER MUST BE IN THE MANUAL MODE FOR THIS PROCEDURE.

1. Mount the Small Cone, Medium Cone and the clamping sleeve on the shaft.

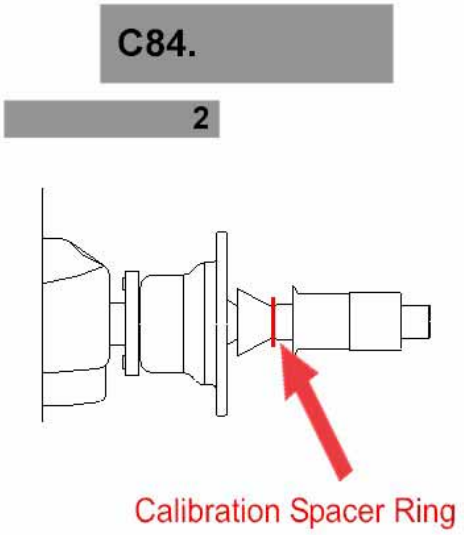
2. Lower the hood and press the **<START>** button to begin the measuring run.



3. After the spin cycle completes remove the clamping sleeve and install the 4mm calibration ring (EAM0033D53A) between the Medium Cone and the clamping sleeve. Press the **<Spin>** button for the balancer to complete a spin cycle. After the balancer comes to a stop the empty shaft calibration is complete.

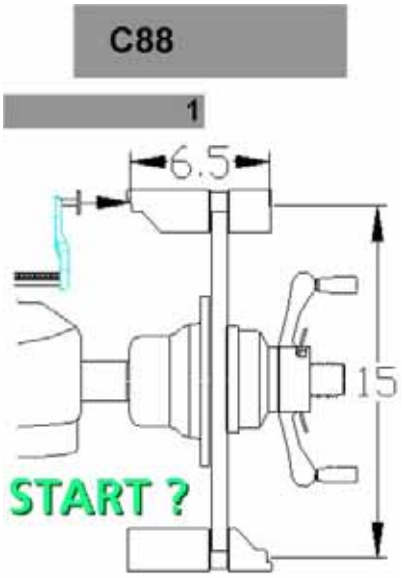
4. Store the new factors using C90.

CALIBRATION COMPLETE

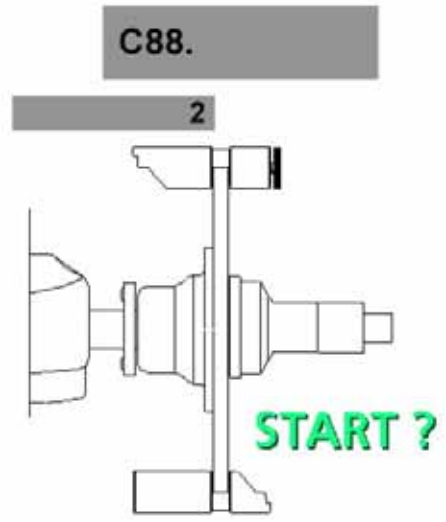


C88 WHEEL WEIGHT POSITIONING

1. Mount the Pruefrotor on the balancer shaft and enter in the parameters of the Pruefrotor using the balance screen. Press the **<START>** button to begin the measurement run.



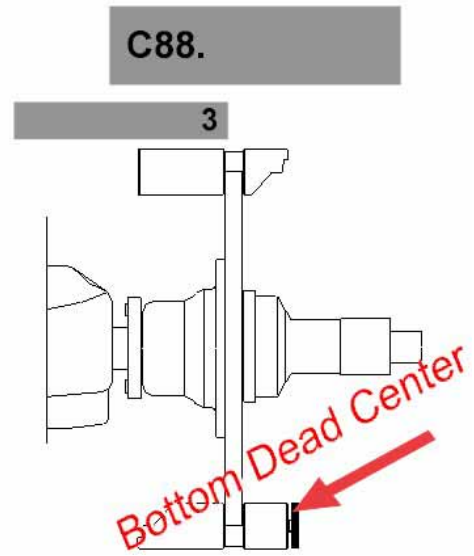
2. Attach the 100 gram weight to outside of the Pruefrotor and press the **<START>** button.



3. After the shaft comes to a complete stop rotate the shaft to locate the 100 gram weight at "***BOTTOM DEAD CENTER***" position. Press the <***ENTER>*** key (F6) to save the data.

4. Store the new factors using C90.

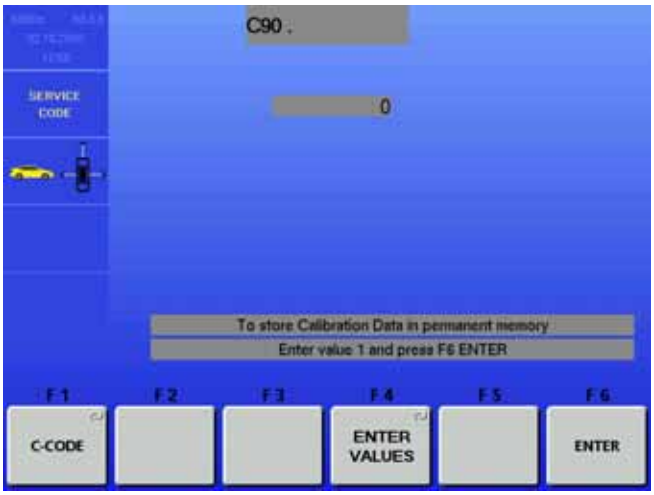
CALIBRATION COMPLETE



C90 SAVING CALIBRATION DATA

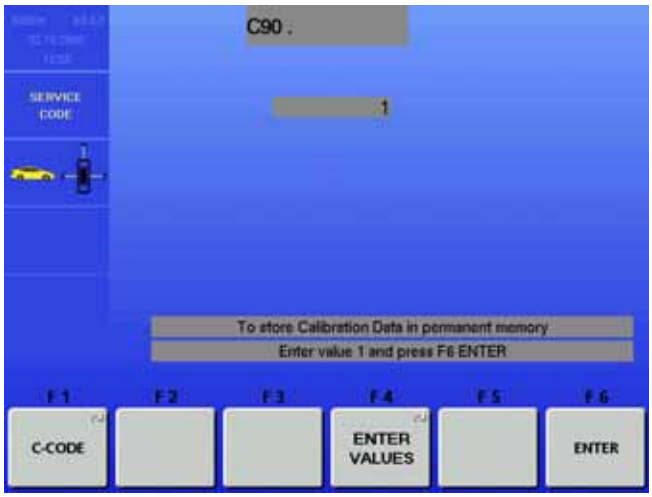
All calibration data must be saved into memory before powering down the unit. Any data that is not saved will be lost if the power is recycled.

1. Press and hold the <***ENTER VALUES***> key (F4) and rotate the shaft to change the selection window from “0” to “1”, release the key.



2. Press the ***<ENTER KEY>*** to save all previous calibration data to permanent memory.

CALIBRATION DATA SAVED



C98 POWER CLAMP ENCODER

Once the code is called up the reading should display “---”. After the incremental encoder has identified zero reference, the angular location is displayed in a range between 0 and 63. Use of this C code and meaning are identical with C code 74.

If this test should fail (no 23F) check the following:

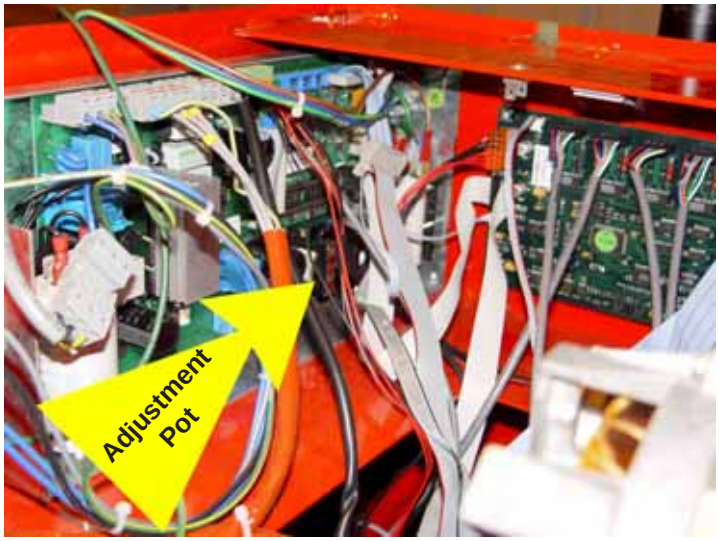
- Cables of the opto switch
- Connectors on cable
- Clean the incremental encoder tape.

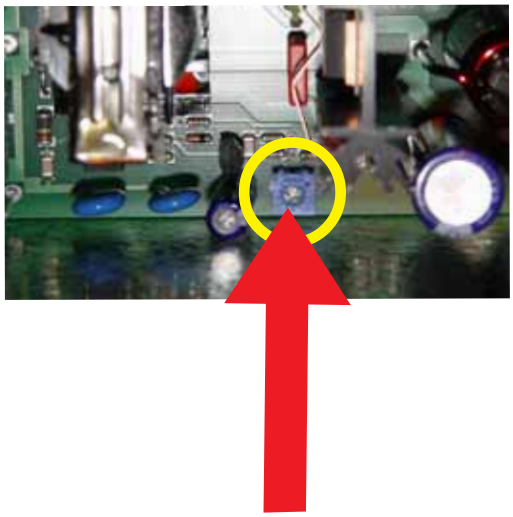
C110 VCC VOLTAGE

The operating voltage of the processor is +5.23 VDC ± .25 volts. If the voltage is out of range the balancer may experience a reset problem or it may display 81118b indicating that the voltage is to high or 81018b indicating that the voltage is below the acceptable range. A small adjustment on the balancer power supply can be made. Follow the procedure below to bring the voltage within the acceptable range. Before adjusting the output voltage of the power supply observe the voltage reading using C110 and record this reading. Place a DVM on the input power leads on the embedded PC, the acceptable voltage is +5.10 ± .05 A difference of **.20** volts between the output (power supply pcb) and input (embedded PC) may indicate a problem with a connection or cable. Repairs must be made before attempting the voltage adjustment below.

⚠ CAUTION!
HIGH VOLTAGE PRESENT

1. Remove the weight tray.
2. Remove the cover from the power supply.
3. Power up the unit.
4. Enter the service menu and press <C110>.
5. Using a tweaker tool, adjust the voltage between +5.20 and +5.26 VDC.





6. Verify the voltage reading at the embedded PC connection to ensure that it is acceptable.

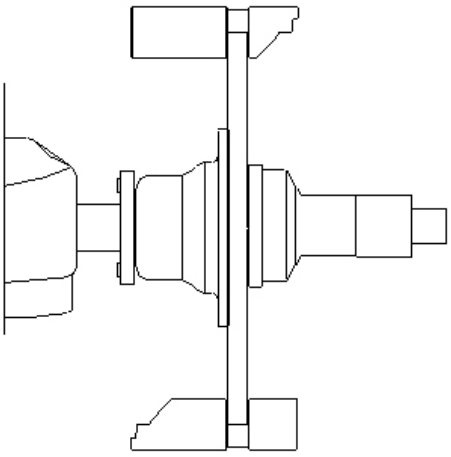
C120 ENABLE / DISABLE LASER POINTER

0 = Disable laser pointer
1 = Enable laser pointer
This feature will turn the laser on/off during the ALU-S mode. It is recommended that the laser should be enabled.

C122 SCANNER / LASER / CCD CALIBRATION

Before the Scanner assemblies can accurately obtain the data needed to balance the wheel and tire assembly they must be calibrated. The calibration information is stored on the CCD / Scanner PCB. This information is stored automatically after completing the calibration. It is recommended that a check of scanner adjustments be made using the C123 procedure before calibrating the scanner assemblies.

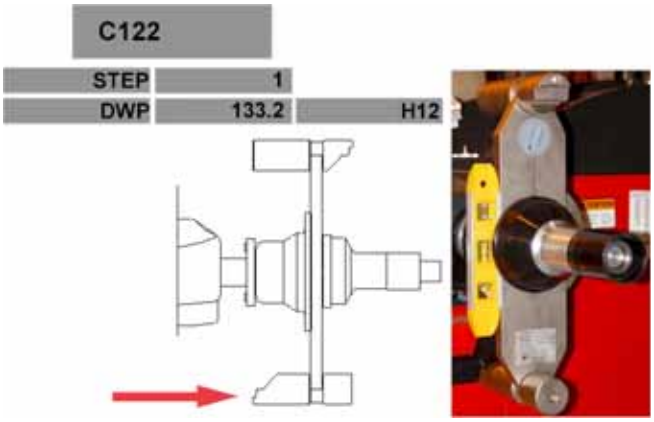
NOTE: THE BALANCER MUST BE IN THE MANUAL MODE AND ALL PRUEFROTOR PARAMETERS ENTERED BEFORE CONTINUING THIS PROCEDURE . AT LEAST TWO REVOLUTIONS OF THE SHAFT SHOULD BE MADE SO THAT THE SHAFT ENCODER CAN LOCATE HOME REFERENCE. THIS CAN BE DONE BY QUICKLY ROTATING THE SHAFT UNTIL THE ENCODER READS.



1. Mount the Pruefrotor as shown in the figure on the right, making sure the the orientation of the Pruefrotor is turned correctly. Failure to do so will fail the calibration procedure.

2. Using a small magnetic torpedo level, turn the shaft until the Pruefrotor is in the verticle position.

3. Press the **<*Enter*>** key (F6). After doing so the display will change and display a random number. This number is not important however make note of the number for the next step. For our example we have used 133.2.

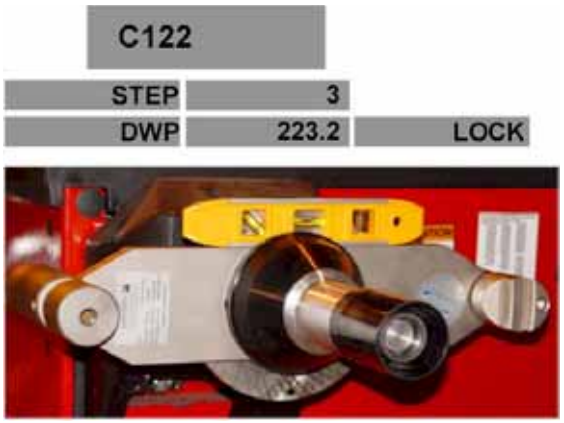


4. Slowly rotate the shaft clockwise 20° (153.2). The display will quickly show “LOCK” and the magnetic brake of the balancer will engage. The inner scanner will scan the inside profile of the Pruefrotor DO NOT MOVE THE SHAFT UNTIL INSTRUCTED. After the scanner completes the profile a beep will sound.

NOTE: LOWER THE HOOD FOR THE FOLLOWING STEPS.

5. Slowly rotate the shaft clockwise 70° (223.2). Once again the ***"LOCK"*** will display and the magnetic brake will engage.

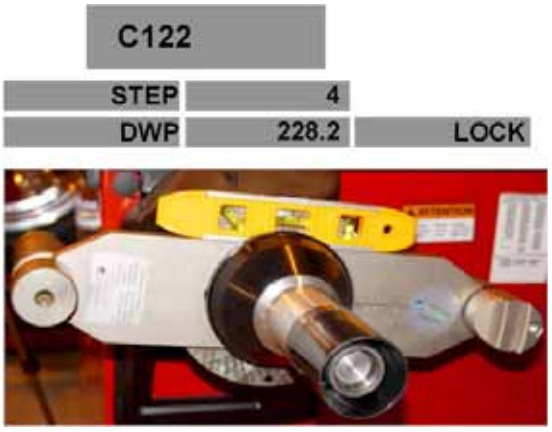
   The outside scanner will begin to take an outside profile of the Pruefrotor The laser light will move from the balancer shaft out to the end of the Pruefrotor (See the red arrow to the right). After the profile has been taken a beep will sound.



At this point it is possible to proceed two different ways providing you have a "T" calibration tool, UI 2.9 (or higher) AWP 0.71 (or higher). If the balancer has the software and tool to accomodate the "T" fixture proceed to step 6b.

6. Slowly rotate the shaft clockwise 5° (228.2). Once the correct position is reached the **"LOCK"** will be displayed and the magnetic brake will engage and lock the shaft.

   The rear scanner will begin to travel and make a complete cycle from the left to the right and back to the left. The scanner is determining the location of the face of the bell housing and the runout profile of the Pruefrotor.



7. The balancer will emit a tone after completing the calibration procedures and an "**END**" will be displayed for step 5. Perform a C90 to store the new calibration factors.

6b. Unclamp the Pruefrotor and clamp the "T" fixture on the shaft with the reference hole (yellow arrow) away from the balancer. Using a torpedo level, vertically level the "T" fixture. Press **<F6>** to confirm.

7b. Slowly rotate the "T" fixture -85 degrees (CCW) until **"LOCK"** appears and engages the magnetic brake. Hold that position until the brake locks and **"CAL"** appears on the screen. The rear scanner assembly will engage and travel across the back. When the scan is complete the brake WILL NOT release. Firmly grab the "T" fixture and press **<F6>**, the brake will release. Perform a C90 to store the new calibration factors.

NOTE: IF AN "ERROR" OCCURS DURING CALIBRATION REPEAT EACH STEP CAREFULLY. SHOULD AN ERROR OCCUR A SECOND TIME MAKE SURE EACH SCANNER IS ADJUSTED CORRECTLY USING C123.

CALIBRATION COMPLETE

C123 DIAGNOSTIC FUNCTIONS

When troubleshooting the BFH/Optima series balancer it is recommended that the technician use the diagnostic information that is available on screen in both the C122 and C123 functions. Information from each scanner / laser assembly is reported on screen and is color coded for easy diagnostics. When the balancer is initially powered up the unit will run a self diagnostic test of all internal components. Each of these test are outlined in the service manual (TEEWB519A). After running the internal diagnostic test the software initiates a self test of all 3 scanner and laser assemblies along with the AWP board. If there are any failures to report the technician can determine the failed component using C123. Some failures reported are easily repaired with minor adjustments and calibration and other failures may require scanner replacement.

The information on C122 and C123 is broken into 3 categories:

1. Diagnostic bits - Self diagnostic test on CCD, EEP (memory), Cal (calibration) and ZMarks (home reference). If a Diagnostic bit is in red the unit will display an error code on boot up.
2. Status Flags - Status flags are used to indicate that a command has been issued to a device and the device has responded to the command. This does not mean that the component is functioning correctly.
3. Analog Inputs - There are eight A/D converter channels checked. Normal Analog errors reflect AWP failures.

When analyzing data from C122 / C123 diagnostic screen the scanner and laser assemblies are identified as:

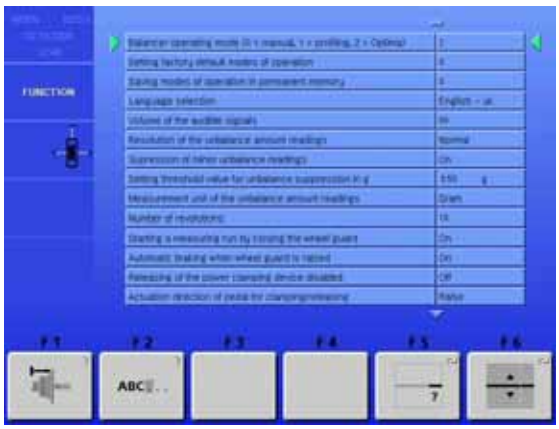
Inside Camera	***Outside Camera***	***Rear Camera***	***Rear Slide Car***
CCD0 (camera)	CCD1 (camera)	CCD2 (camera)	
EEP0 (memory)	EEP1 (memory)	EEP2 (memory)	
Mot0 (motor)	Mot1 (motor)	Mot2 (motor)	Mot3 (motor)
Zmark0 (motor home)	ZMark1 (motor home)	ZMark2 (motor home)	ZMark3 (motor home)

ACCESSING THE DIAGNOSTIC FEATURES

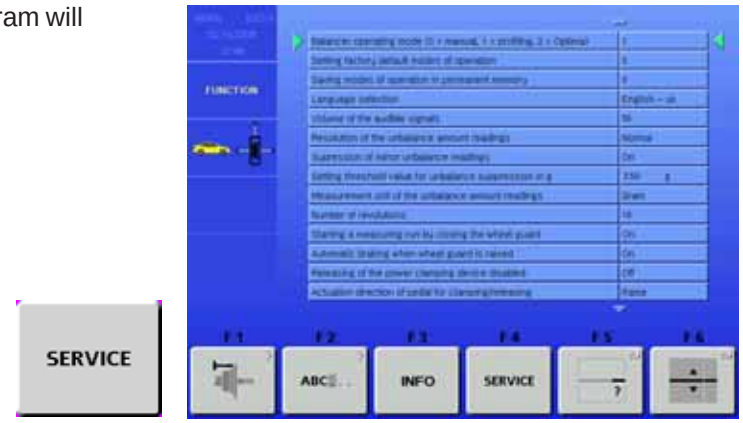
1. From the Introduction Screen press the <***FUNCTION***> key (F1) to enter in to the Function Menu.

2. By pressing the **<F6>** key 3 times successively the "***SERVICE***" key (F4) will become active.

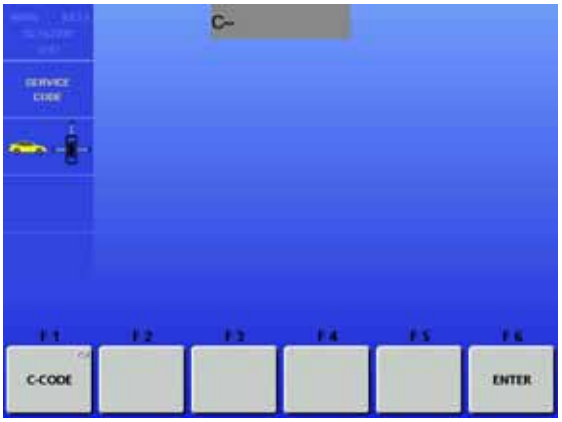
NOTE: BEFORE PERFORMING ANY "C-CODES" ON THE BFH/OPTIMA BALANCER THE TECHNICIAN MUST FORCE THE BALANCER INTO THE MANUAL MODE.

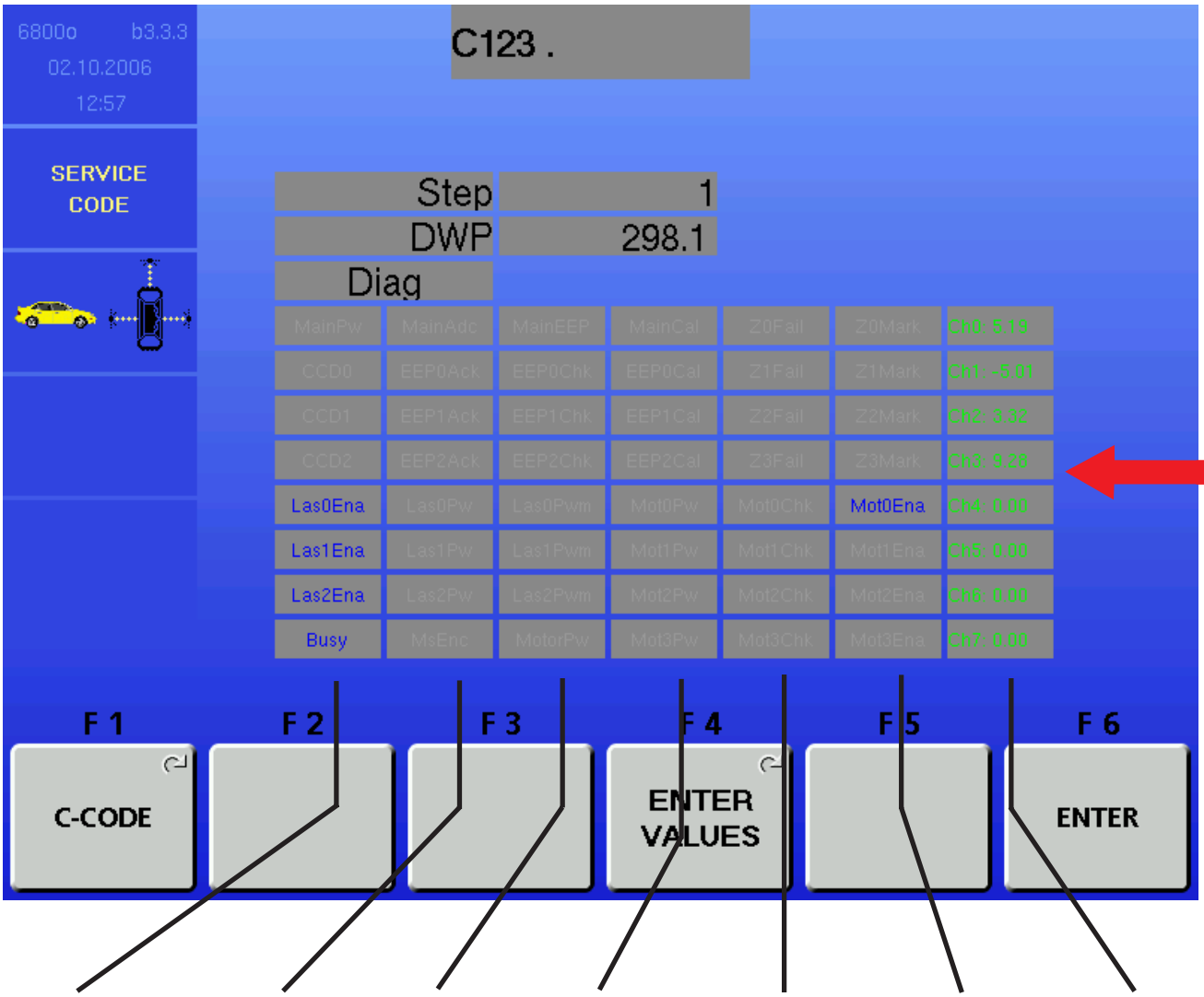


3. By pressing the **<F4>** key the service program will become active.



4. Press and hold the <***C-CODE***> key (F1) and rotate the main shaft the to select C122 or C123. Release the <F1> key once the desired C-code is displayed.





MainPw(0)	MainAdc(36)	MainEEP(4)	MainCal(8)	Z0Fail(12)	Z0Mark(28)	Ch0:X.XX
CCD00(1)	EEP0Ack(33)	EEP0Chk(5)	EEP0Cal(9)	Z1Fail(13)	Z1Mark(29)	Ch1:X.XX
CCD1(2)	EEP1Ack(34)	EEP1Chk(6)	EEP1Cal(10)	Z2Fail(14)	Z2Mark(30)	Ch2:X.XX
CCD2(3)	EEP2Ack(35)	EEP2Chk(7)	EEP2Cal(11)	Z3Fail(15)	Z3Mark(31)	Ch3:X.XX
Las0Ena(45)	Las0Pw(37)	Las0Pwm(41)	Mot0Pw(20)	Mot0Chk(16)	Mot0Ena(24)	Ch4:X.XX
Las1Ena(46)	Las1Pw(38)	Las1Pwm(42)	Mot1Pw(21)	Mot1Chk(17)	Mot1Ena(25)	Ch5:X.XX
Las2Ena(47)	Las2Pw(39)	Las2Pwm(43)	Mot2Pw(22)	Mot2Chk(18)	Mot2Ena(26)	Ch6:X.XX
Busy(44)	MsEnc(40)	MotorPw(32)	Mot3Pw(23)	Mot3Chk(19)	MoteEna(27)	Ch7:X.XX

DIAGNOSITC BITS (SHOWN IN BLACK)

Diagnostic bits, 0 (failure) is displayed in **RED**, 1 (ok) is **GRAY**.

Note: Diagnostics bits will produce an error code.

Bit	Shown label	Meaning	Notes
0	MainPw	Analog/logic power supply	
1	CCD0	Inner CCD signals	
2	CCD1	Outer CCD signals	
3	CCD2	Rear CCD signals2	
4	MainEEP	Main board EEPROM memory valid	
5	EEP0Chk	Inner EEPROM memory valid	
6	EEP1Chk	Outer EEPROM memory valid	
7	EEP2Chk	Rear EEPROM memory valid	2
8	MainCal	Cameras calibration (E360,C122)	
9	EEP0Cal	Inner scanner factory calibration	
10	EEP1Cal	Outer scanner factory calibration	
11	EEP2Cal	Rear scanner factory calibration	2
12	Z0Fail	Inner motor home mark detection	
13	Z1Fail	Outer motor home mark detection	
14	Z2Fail	Rear motor home mark detection	2
15	Z3Fail	Rear shift motor home mark detection	2
16	Mot0Chk	Inner motor missing steps	
17	Mot1Chk	Outer motor missing steps	
18	Mot2Chk	Rear motor missing steps	2
19	Mot3Chk	Rear shift motor missing steps	2
20	Mot0Pw	Inner motor current sink / power check	1
21	Mot1Pw	Outer motor current sink / power check	1
22	Mot2Pw	Rear motor current sink / power check	1 - 2
23	Mot3Pw	Rear shift motor current sink / power check	1 - 2
32	MotorPw	External motor power supply	1
33	EEP0Ack	Inner EEPROM memory ACK	
34	EEP1Ack	Outer EEPROM memory ACK	
35	EEP2Ack	Rear EEPROM memory ACK	2
36	MainAdc	Camera board A/D converter check	
37	Las0Pw	Inner laser current sink / power check	1
38	Las1Pw	Outer laser current sink / power check	1
39	Las2Pw	Rear laser current sink / power check	1 - 2
40	MsEnc	Shaft encoder zero mark detection	3
41	Las0Pwm	Inner laser modulation	1
42	Las1Pwm	Outer laser modulation	1
43	Las2Pwm	Rear laser modulation	1 - 2

Notes:

1. Available only on new camera boards (EAP0204G50B), default to 1 on former boards.
2. Obviously fails on any BFH/Optima without the rear scanner. (this unit does not have a rear scanner and camera assembly)
3. Valid after runout measurement only.

STATUS FLAGS (SHOWN IN BLUE)

Status Bits, 0 (disable) is displayed in **GRAY**, 1 (enable) is **BLUE**.

Bit	Displayed	Meaning
24	Mot0Ena	Inner motor power enable
25	Mot1Ena	Outer motor power enable
26	Mot2Ena	Rear motor power enable
27	Mot3Ena	Rear shift motor power enable
28	Z0Mark	Inner motor home mark
29	Z1Mark	Outer motor home mark
30	Z2Mark	Rear motor home mark
31	Z3Mark	Rear shift motor home mark
44	Busy	Firmware ready/busy status
45	Las0Ena	Inner laser power enable
46	Las1Ena	Outer laser power enable
47	Las2Ena	Rear laser power enable

ANALOG INPUTS: (SHOWN IN GREEN)

For ***Analog Values***, normal data is **GREEN**, out of range is **RED**.

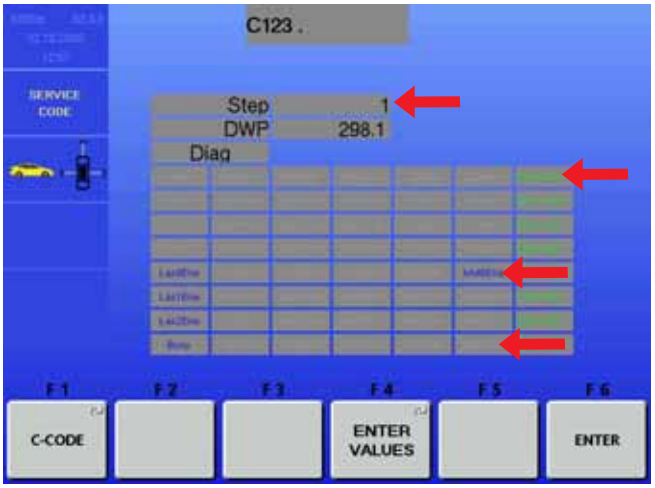
Ch	Analog input	Valid range
0	5.00 V power supply	4.80 V ÷ 5.60 V
1	-5.00 V analog power supply	-5.60 V ÷ -4.80 V
2	3.30 V logic power supply	3.00 V ÷ 3.60 V
3	9.00 V external motor power supply	8.00 V ÷ 12.00 V
4	AUX 0 external input	0 V ÷ 4.096 V
5	AUX 1 external input	0 V ÷ 4.096 V
6	Laser current sink	0 V ÷ 4.096 V
7	Motor current sink	0 V ÷ 4.096 V

C123 MECHANICAL SCANNER / LASER / CCD ADJUSTMENT

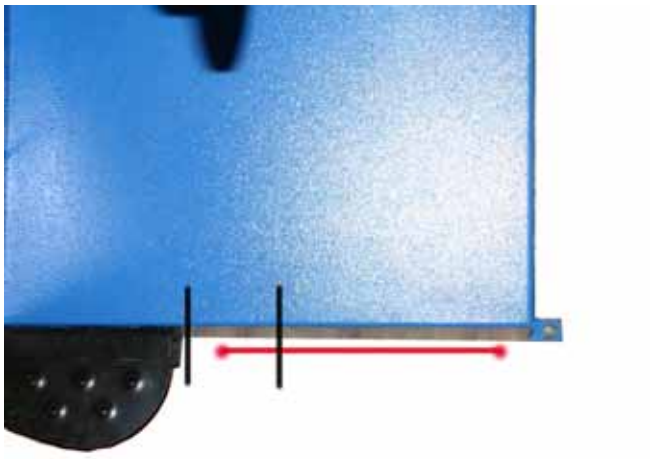
If the BFH/Optima balancer fails any part of the C122 camera calibration it may be necessary to adjust one or more of the cameras. If any of the Scanner assemblies require replacement it will also be necessary to check the mechanical adjustment before calibration.

1. Access the service menu and program the balancer to run C123.

2. Step 1 accesses and avtivates the inside laser and “motor 0”. Press the **<Enter>** key (F6) to start the inside scanner. Deactivate the scanner motor by pressing the **<Enter>** key (F6).



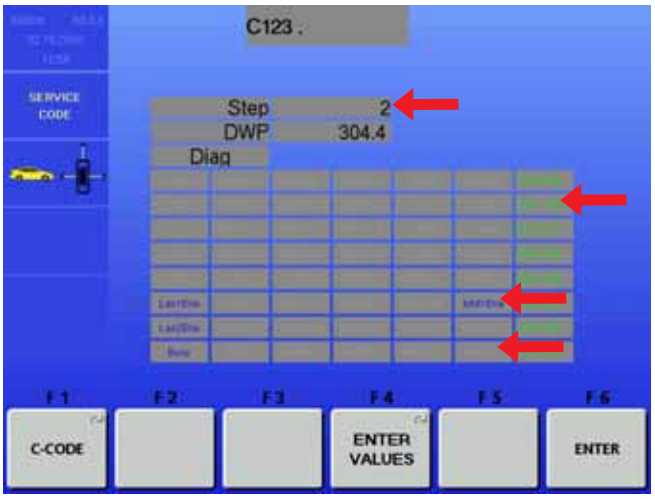
3. Looking down at the anchor tab just under the main shaft a laser light will be illuminated. The figure to the right shows the direction of travel. The scanner must stop somewhere between the two black illustrated lines. See ***“Inside Scanner Adjustment”*** for procedure.



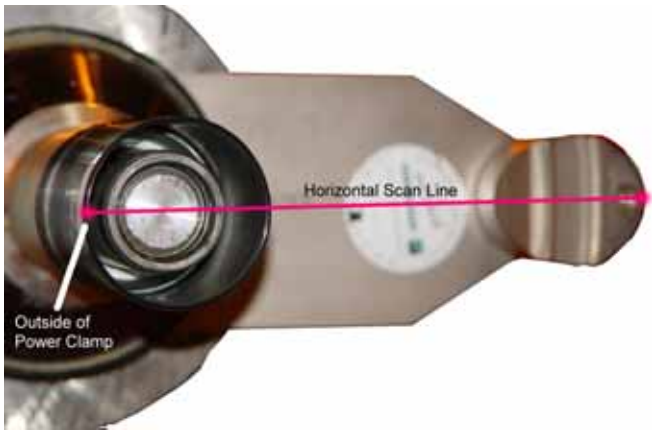
4. Press the **<Enter Values>** key (F4) and turn the shaft to proceed to the outside scanner.

5. Step 2 accesses and runs the outside scanner test “motor 1”. The Pruefrotor must be mounted on the shaft to verify the accuracy of this test.

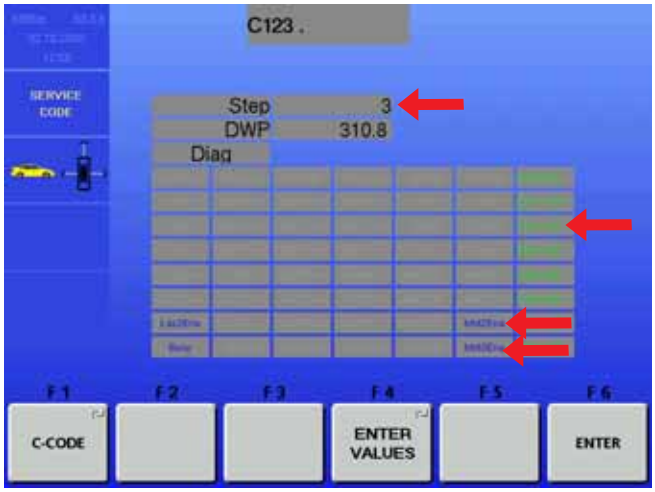
NOTE: THE HOOD OF THE BALANCER MUST CLOSE TO THE CORRECT HEIGHT BEFORE ANY ADJUSTMENTS ARE MADE. SEE “HOOD ADJUSTMENT” FOR THIS PROCEDURE.



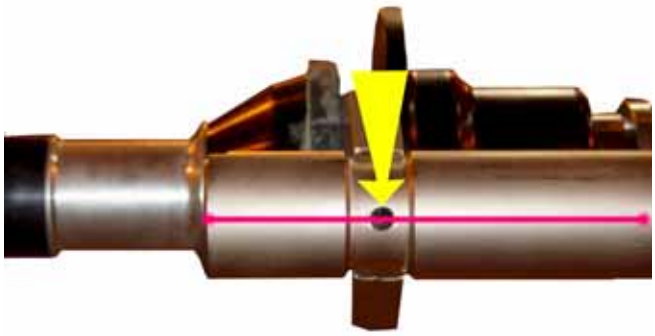
7. Press the **<Enter>** key (F6) to start the outside scanner motor and laser. The laser must scan from the outside edge of the power clamp horizontally across the Pruefrotor towards the back of the balancer. See *Outside Scanner Adjustment* for procedure. Press the **<Enter>** key to stop the scanner motor and to proceed to the next step.



8. Press the ***<Enter Value>*** key (F4) and turn the shaft to access the rear scanner “motor 2”. Rotate the Pruefrotor forward 5° from a level position.



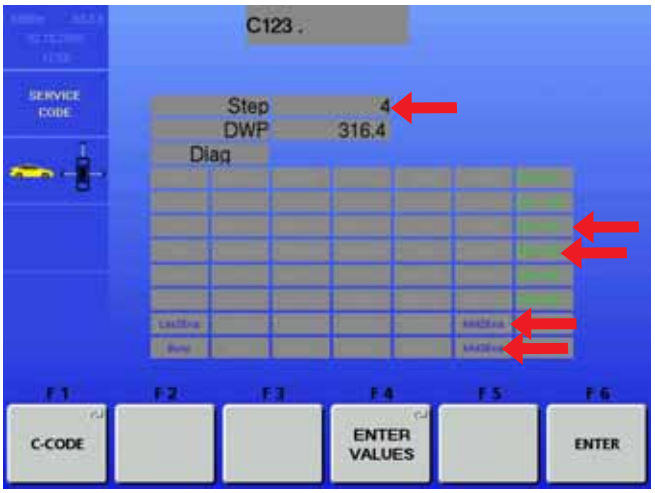
9. Press the **<Enter>** key (F6). The rear scanner assembly will leave the home position and stop towards the middle. The scanner motor will begin to move between two fixed points. The laser line should fall somewhere within the cutout hole on the Pruefrotor.



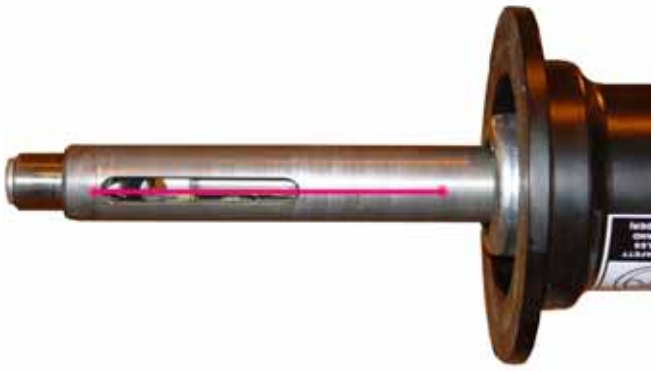
If the laser line does not scan the prefered area, adjust the hex screw on the back of the assembly to move the laser to the correct position.

Hex adjustment screw

10. Press the **<Enter>** key to stop the scanner motor and to proceed to step 4. Press and hold the ***<Enter Value>*** key (F4) and turn the shaft to access the rear scanner horizontal drive “motor 2”.



11. Remove the Pruefrotor from the shaft. Press the **<Enter>** key (F6). The rear scanner will begin to scan from left to right. From the rear of the unit see where the laser line is running along the shaft. The rear drive laser should run parallel with the shaft and in the center. If the laser does not run parallel with the shaft the rear scanner assembly may not be mounted parallel with the cabinet or the vibratory system may not be level with the cabinet. Press the **<Enter>** key (F6) to stop the motor drive. Press the **<Esc>** key on the keyboard to exit this test.



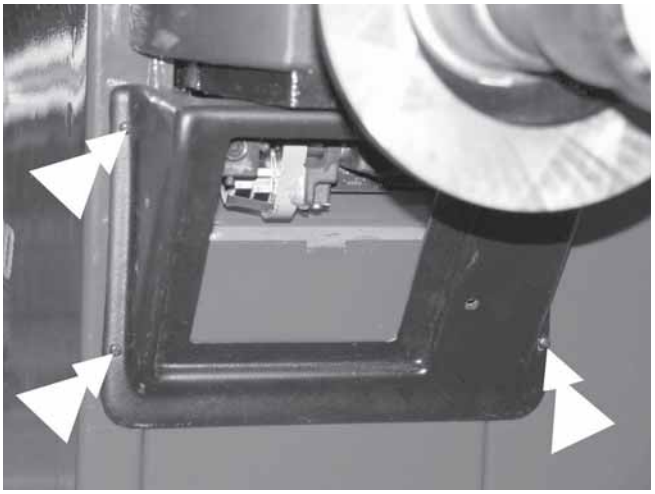
CCD / LASER / SCANNER INSTALLATION

Should any of the scanner assemblies require replacement it will be necessary to make some mechanical adjustment before calibrating the unit (C83, 84, 88 and 122) and returning it to service. These adjustments should run parallel with the C123. **The ribbon cable that feeds the CCD must have some slack at the scanner assembly**. This can be tested by manually pressing on the scanner assemblies. A small amount of play is necessary and they should return to the home postion.

INNER SCANNER INSTALLATION

1. Power down the unit.

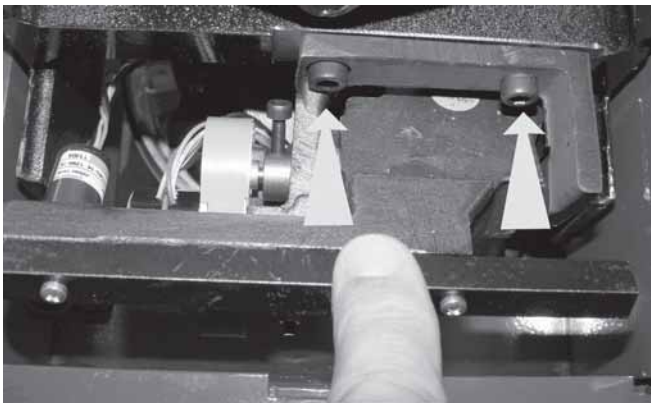
2. Remove the 4 phillip screws that secure the shield.



3. It may be necessary to manually swing the scanner assembly downward to access the bolts that secure the assembly to the vibratory.

4. Remove the two Socket Head Cap Screw that secure the assembly to the vibratory. DO NOT DROP THE SCANNER ASSEMBLY.

5. Disconnect all cables and reverse this procedures for installation.



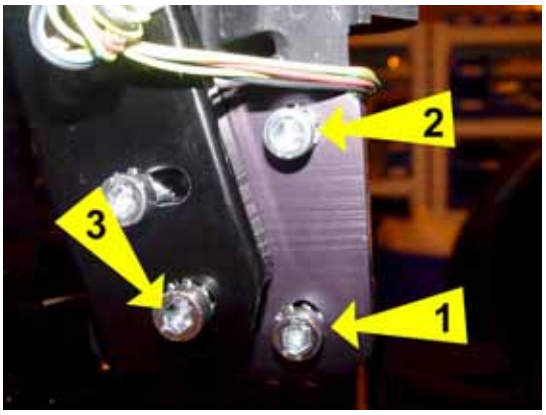
OUTER SCANNER INSTALLATION

1. Power down the unit.

2. Remove the 4 phillip screws that secure the shield.

3. Firmly hold the scanner assembly and remove the 2 Socket Head Cap Screw (1 and 2) that secure the scanner assembly to the hood frame.

4. Disconnect all cable assemblies and reverse the procedure for installation.



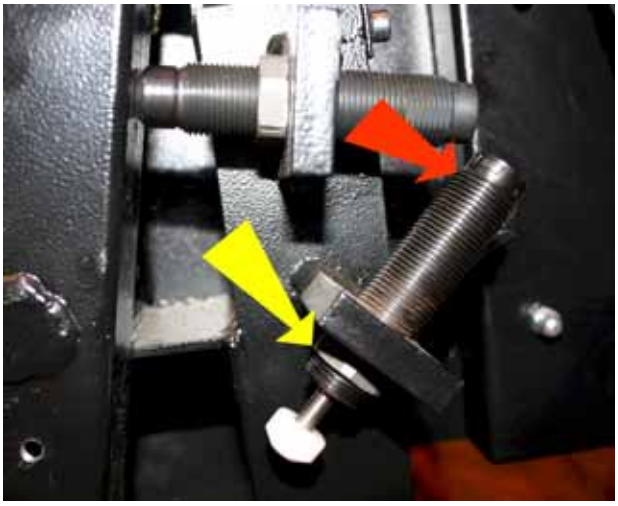
NOTE: IF A CABLE IS REPLACED AND A ZIP TIE IS CUT OR SILICON ADHESIVE BOND IS BROKEN IT IS VERY IMPORTANT TO REINSTALL THESE SECURING FEATURES.

HOOD ADJUSTMET

Before making any adjustments to the outside scanner it is recommended that the hood be checked for the proper height in the closed position. Failure to do so could cause the outside scanner to fail during a C122 calibration.

5. Measure the distance from the ground to the center of the shaft and record this distance. Measure distance between the ground and the center of the adjustment screw labeled (3) in the figure above. If the measurements are different the hood must be adjusted to match the two measurements.

6. Loosen the Hex screw on the back side of the hood block. Loosen the jam nut (yellow). Using a wrench turn the adjustment screw (red) until while monitoring the height between the ground and the screw mentioned in step 5.

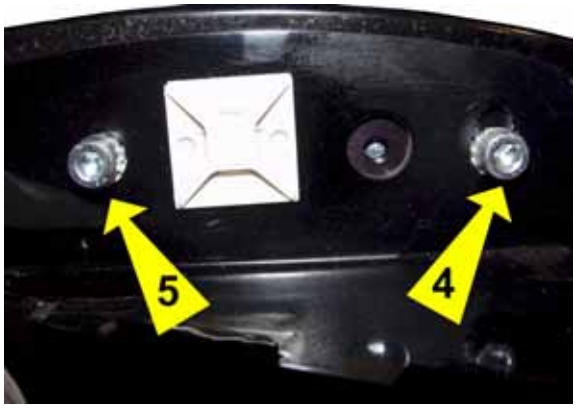


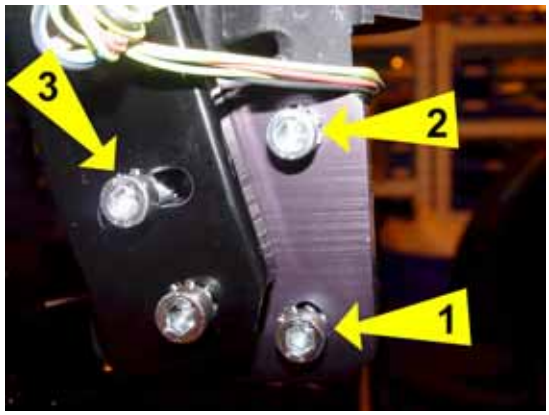
OUTER SCANNER INSTALLATION *CONTINUED*

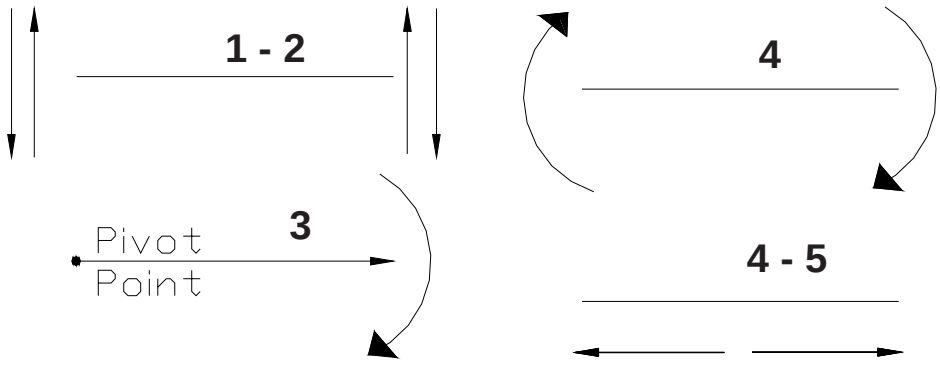
The HOME reference and the orientation of the projected laser can only be adjusted using the mounting screws listed below. ***NOTE: DO NOT TAMPER WITH THE SCANNER ASSEMBLY. THE SCANNER ASSEMBLY COMES CALIBRATED FROM THE FACTORY.***

7. Mount a Pruefrotor on the balancer shaft and secure. Program the balancer for step 2 of C123. Verify that the laser light moves horizontally from left to right. The illustrations below show the direction that the laser line moves using the adjustments screws. Each direction of movement can and will effect the other adjustments. In most cases the number (1 & 2) adjustment screw is the only needed movement after replacement of a scanner. Secure all screws.
8. If the number 1 & 2 adjustment screw do not bring the laser within specification it may be necessary to adjust all adjustment screws. Before doing so it is recommended to level the scanner in two locations before any adjustments are made. Doing so will bring the scanner very close to specs and only a small amount of adjustment will be necessary. Level the scanner in the two locations indicated.

9. Using the adjustment points below will adjust the projected scanner light in the following orientation.







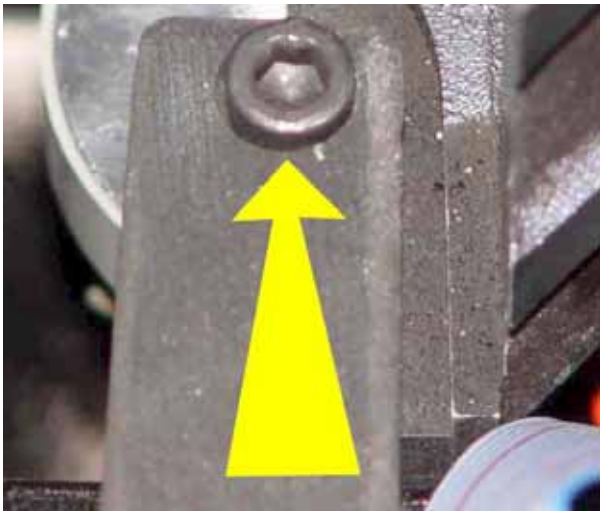
REAR SCANNER INSTALLATION

1. Remove the rear cover from the Slide Car.

2. Remove the philip screws from the scanner box.

3. Remove the front glass from the scanner box.

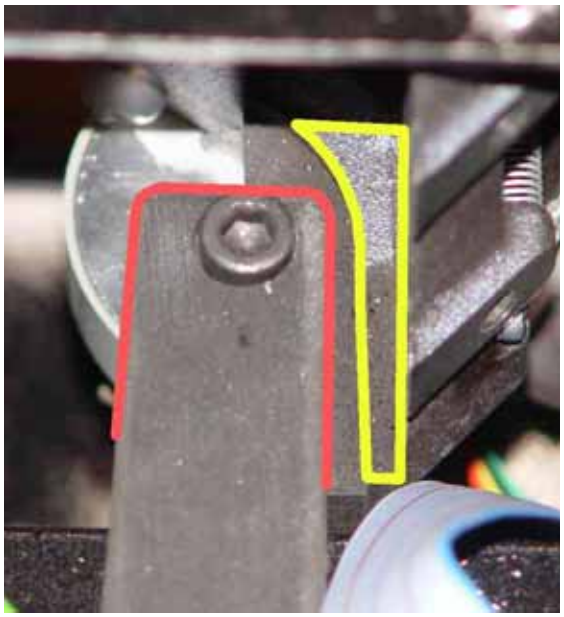
4. Remove the (1) Hex screw securing the scanner assembly and disconnect all wires.



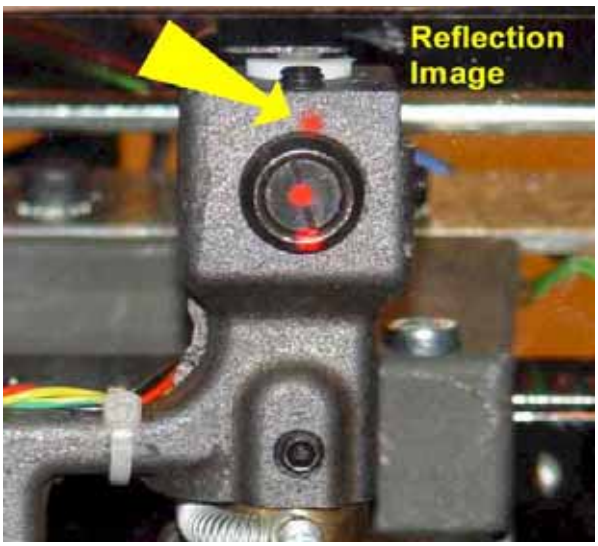
5. Special attention must be spent when installing the rear scanner assembly. The scanner bracket and the mounting bracket must be aligned parallel with each other.

6. Install the protection glass onto the scanner box assembly.

7. Program step 4 of C123.



8. Look at the reflection of the laser back on the scanner. The reflection should come close to being on top of the original light source.

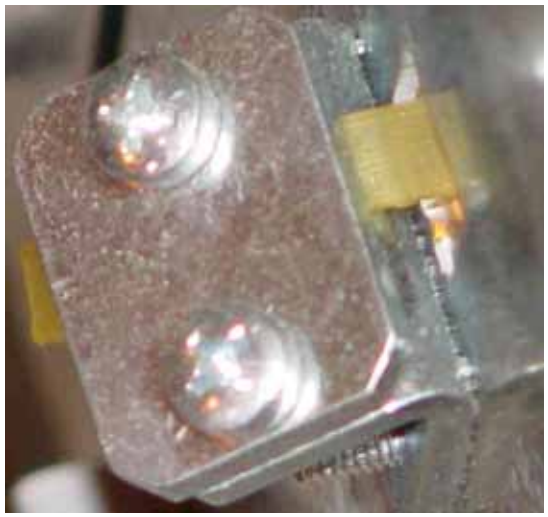


NOTE: AFTER ANY CHANGES AND OR ADJUSTMENTS TO EACH OF THE 3 SCANNERS THE BALANCER MUST BE CALIBRATED. FAILURE TO CALIBRATE THE BALANCER WILL YIELD ERRORS.

REAR SCANNER DRIVE BELT

The belt that drives the rear scanner inside the housing is a one piece cog belt. Over time the belt may be come hard and brittle and require replacement. The belt will come as a single belt that needs to simply be cut. The rear scanner assembly moves across the back of the balancer using a drive motor mentioned earlier. The drive motor has a cog gear mounted that drives the scanner assembly.

1. Loosen the two Phillips sheet metal screws and remove the broken or damaged drive belt.



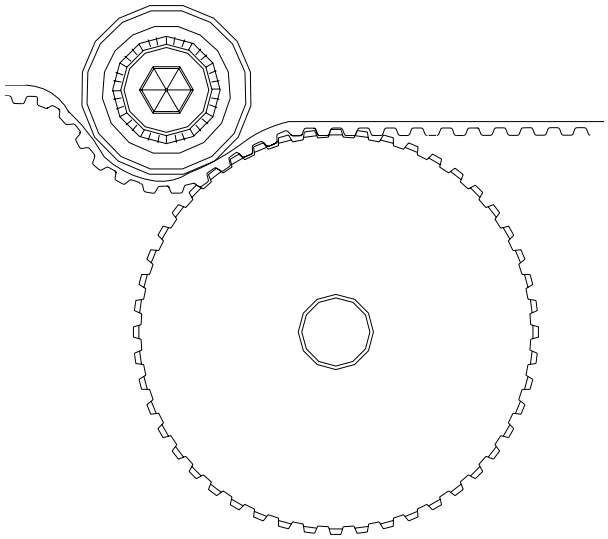
2. Remove the rear cover of the rear drive assembly.

3. Using a pair of scissors cut the new drive belt and install the one end of the belt with the cog side facing down.

4. Feed the belt through the drive assembly. It may be necessary to loosen the motor to feed the belt through. Once the belt is installed lift up on the drive motor, this will tighten the belt and not allow it to slip off the gear drive.

5. Tighten each end that secures the belt. DO NOT OVER TIGHTEN THE SCREWS SECURING THE BELT, THIS MAY CUT THROUGH THE BELT.

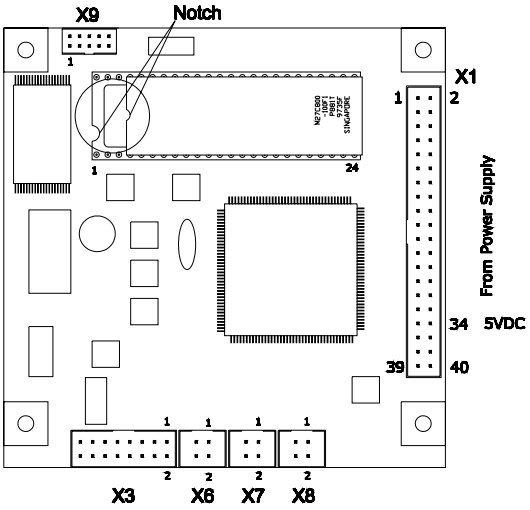
6. Snip the remaining excess and retest the rear drive.



FIELD PROGRAMMING THE CAMERA PROCESSOR PCB

The BFH/Optima has two processors that can be programmed. The main processor which is inside of the Electronic box and the Camera Controller PCB. Each processor is programmed using the EEprom socket on the Main Processor PCB. Programming the main Processor is mentioned earlier in this manual. The camera processor PCB is flashed in the same manner.

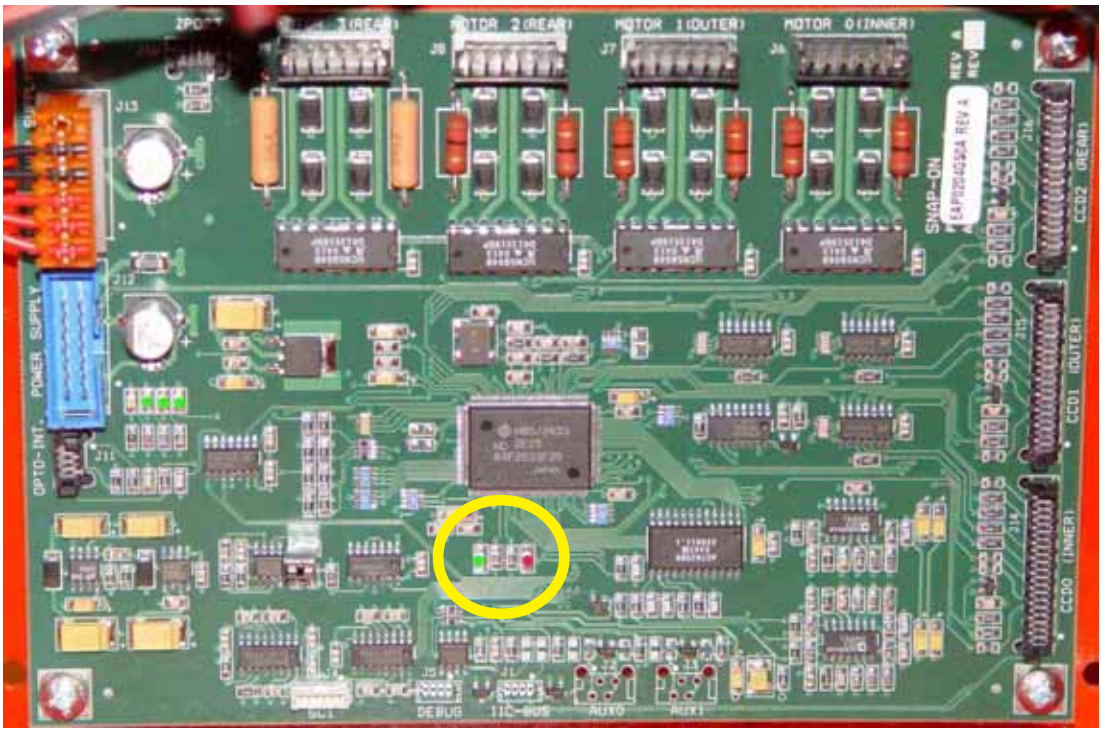
1. Turn off balancer.
2. Place EEPROM in micro-controller socket with flat end at bottom of socket close to large blue connector. The notched end is 3 spaces short of other end of socket.
3. Turn on balancer.
4. The following is a sequence of events that will take place; three light audible beeps accompanied by 3 green light flashes on the Camera PCB followed by 1 red flash followed by 3 more green flashes followed by a constant flicker of the red LED. (Location Circled Below).
5. A continuous sequence of tones will sound from the keyboard indicating that the program loading is complete and the red LED will stop flashing.
6. Turn off the balancer.
7. Remove EEPROM and turn on the balancer.
8. The normal startup procedure will be performed.



NOTE: IF A NEW COMPACT FLASH IS INSTALLED ON THE EMBEDDED PC IT WILL BE NECESSARY TO PERFORM A "C47" AFTER INSTALLTION. FAILURE TO DO SO WILL NOT DISPLAY ANY NEW GRAPHICS OR FEATURES THAT WERE INSTALLED.

9. Perform service codes in the following order;
   - **C123** - Verify all scanner are profiling correctly
   - **C122**- Calibration of all 3 scanner assemblies.

The machine is now ready for use.



REMOVING THE BELL HOUSING

It may be necessary to remove the bell housing from the vibratory member to either clean or replace it. Follow the process below.

1. Un-plug the balancer from the power source.

2. It may be necessary to remove the weight tray. Using a 13mm wrench slightly loosen the 2 bolts securing the bell housing to the main shaft.

3. Turn the main shaft and the bell housing opposite direction to line the Hex Head Cap Screw with the keyhole.

4. Using a rubber mallet tap the face of the bell housing to break taper of the shaft.

5. Pull the bell housing out away from the balancer.

6. Hold the main shaft and turn the bell housing clockwise, un-screwing and separating the two shafts.

7. When installing a new bell housing or re-installing the old bell housing make sure that both tapered portions are clean and free from any dirt particles. Failure to do so may cause damage to both pieces and separation may be impossible.

8. Always make sure that the bell housing is fully screwed onto the main shaft before aligning the key holes. This can be accomplished by pulling the bell housing away from the balancer and making sure that the bell housing is fully screwed onto the main shaft.

IMPORTANT BALANCER INFORMATION

Before calling technical support it will be necessary to know what revision of balancer is being serviced. Follow the steps below to enter the “Info” screen.

1. From the Introduction Screen press the “***FUNCTION***” key (F1) to enter in to the Func tion Menu.
2. By pressing the **F6** key 3 times successively the “***INFO***” key (F3) will show.

3. By pressing the **F3** key the “***INFO***” will become active.

4. Make note of the following line items:

   User Interface - Revision Number and Date (Revision may not change however date may.

   Balancer Kernel - Revision Number and Date

   Display - Revision Number and Date

   Optima - AWP, Version Number

QUALIFYING THE BALANCER

The BFH/Optima is a very precision piece of equipment. In order for each scanner to accurately measure tire and wheel profiles each scanner must be adjusted and calibrated within manufactures specification. Below is a step by step procedure that can easily be followed to qualify the BFH/Optima . Each of these procedures should be checked on every service call. These steps will validate each component, should a failure of a component occur the balancer will not pass one of these test and it will be necessary to complete a more in depth analysis.

1. Change the balancer to manual mode (Page 5-12)
2. Check C55 for the proper supply VAC in.
3. Check C110 for proper voltage +5.23 VDC ± .05
4. Check that the proper voltage is being supplied to the embedded PC+5.00 VDC ± .25 volts. (See adjustment)
5. 9 volt camera power supply - The output voltage of the camera power supply is 9.25 VDC ± .25 (See adjustment)
6. C83 - Manufactures vibratory calibration. (Pruefrotor required)
7. C84 - Empty shaft calibration. (4mm Calibration ring required)
8. C88 - Top Dead Center (TDC) wheel weight positioning. (Pruefrotor required)
9. C123 - Mechanical adjustment of all three camera assemblies.
10. C122 - Calibration of all three camera assemblies. (Pruefrotor required)
11. Change from Manual Mode back to customers preference.

NOTE: RUN A C90 PROCEDURE AFTER STEPS 4,5& 6.

APPENDIX A
CODES

KERNEL CODES

A complete error code consists of 6 hexadecimal digits.

Prefix	Digit 6	Digit 5	Digit 4	Digit 3	Digit 2	Digit 1
0X	Module ID		Priority ID	Error ID		
Digital Display	Left Display			Right Display		

Module ID: 2-digit hexadecimal value and indicates the software module which detected the error.
Priority ID: Represents the kind of error (message only, critical error).
Error ID: Determines the kind of the fault.

Module ID	Description
21	Time Service
22	I2C bus device driver
23	Serial device driver
24	Sound device driver
25	External AD converter
26	Internal AD converter
27	Temperature measurement
28	Piezo transducer
29	Incremental encoder Main shaft
2A	Incremental encoder belt disc
2B	Relay management
2C	Hand-spin brake
2D	Electromagnetic brake
2E	main supply line
2F	motor
30	Supervisor
31	Watchdog timer
41	Auto stop system
42	Data conditioning
43	Rim data management
44	Sape device
45	Display device
46	Keyboard device
47	Brake device
48	Motor device
49	Drive (Motor & Brake)
4A	Power clamp
4B	Incremental potentiometer
4c	Rim light
61	Balancing algorithm
62	Balancing calibration
63	Behind the spokes placement
64	<not used>
65	Optimisation
66	Measurement control

81	Command language (Commands coming from the UI)
82	Calculator
83	Message Server (Message service from BK to UI)
84	Message Server (User messages from BK to UI)
85	Sleep command
86	Balancing Kernel : Test statemachine (eg selftest during startup)
A1	Event system
A2	User management
A3	State machine
A4	complex data type
A5	Persistent objects
A6	Pipe device
A7	Power on time counter (-> time stamp for error recording)
A8	Counter for total spins / in service-, in user mode
C1	Self test
C2	User interface
C3	User interface

Priority ID	Description
0	Critical error (will be recorded in user mode)
1	Warning message
2	For information only
3	All of above, but will not be recorded in the error record (persistent objects p30 to p39)

Error ID	Limits	Description
F01		Not complete
F02		Invalid job
		Mod 2D, Brake : Module gets invalid event.
		Mod 49, Drive system : Internal error, command not valid in actual mode of operation
		Mod 66, Meas Control : Internal error. Module gets invalid user event. command not valid in actual mode of operation
		Mod C1, Self-test : Self-test failed, see error record for more information (kernel register err0,...err9 or User interface: C28).
F03		Out of memory
F04		Out of range Mod 27, Temperature: Out of Range
F05		Buffer full
F06		Channel not found
F07		Not found
		Mod 41, ASS : Time client not found
		Mod 44, SAPE : Time service not found during unregister
		Mod C1, Self-test : Self-test failed, result of test invalid
F08		Already exists
F09		In use
		Mod 44, SAPE : AWP already in use
		Mod 49, Drive system : Internal error, command not valid in actual mode of operation
		Many “490F09” errors in the error record indicates a malfunction of the pedal.
F0A		End of file
F0B		Drive full

Error ID	Limits	Description
F0C		Bad name
F0D		Xmit error
		Mod C3, User Interface : **Communication Error between balancing kernel and user interface (BK <- UI). Machine should be restarted.**
		This error can be caused by a bad connection of the RS232-E serial line. Check external and internal cabling.
F0E		Format failed
F0F		Bad parameter
		Mod 41, ASS : Invalid time specified
		Mod 44, SAPE : Bad parameter during calling time service
		Mod 81, cmd : Parameter of a kernel command is bad. Such an error can occur as a result from a hardware malfunction.
F10		Bad medium
F11		Error in expression
		Mod C3, User Interface : **Communication Error between balancing kernel and user interface (BK -> UI). This error can be cleared by pressing STOP or Escape.**
		This error can caused by a bad connection of the RS232-E serial line. Check external and internal cabling.
F12		Overflow
		Mod 41, ASS : Too many time clients
		Mod 44, SAPE : Overflow (e.g. invalid time period)
F13		Not implemented
F14		Read only
F15		Bad line
F16		Bad data type
F17		Not running (still not initialised)
		This error can occur after a measuring run, if the incremental encoder of the power clamp is not able to detect the reference mark (810F17). check the incremental encoders with C54, C74 (main shaft) and C98 (power clamp)
F18		Timeout
		Mod 31, Watchdog: Recorded during start-up: Watchdog causes last reset. Check error record (C28).
		Mod 42, Data cond. : Can't get data from external AD converter This error can caused by a malfunction of the incremental encoder. Check C74 and C54. A malfunction of the micro-controller board Check C75 if ADE1 and ADE2 displays valid results.
		Mod 44, SAPE : Communication timeout (No answer from AWP)
		Mod C1, Self-test : Self-test failed, test function does not response (timed out)
F20		Access denied
		Mod 49, Drive system : Access denied : e.g. Use of the clamp device if it is not available (not a power clamp machine?) - Requested action not allowed
50		UT_CMPLX_ERROR_MatrixSingular
60		ERR_VOLTAGE_ZERO
61		ERR_VOLTAGE_BELOW_LIMIT
63		ERR_VOLTAGE_ABOVE_LIMIT
64		ERR_VOLTAGE_really_HIGH
100		Keyboard : No time client available

Error ID	Limits	Description
101		ERROR_KEYB_NO_HARDWARE_AVAILABLE
102		ERROR_KEYB_ORDER_BUSY
120		Display (Digital) : No Hardware available
130		Bad parameter for the frequency of beep command
131		Bad parameter for the volume of beep command
132		Bad parameter for the sound file of beep command
133		Bad parameter for the repetition of a beep
134		Sound file corrupted
140		RS232-E : Wrong parameter for ioctl call.
141		RS232-E : Input buffer overrun occurred
142		RS232-E : Transmission error
143		FIFO_KORRUPT
144		FIFO_WRONG_ACTION
145		FIFO_EMPTY_READ
146		FIFO_FULL_WRITE
147		FIFO_STRING_ENDE
148		PIPE_NO_COMPLETE_MESSAGE_AVAILABLE
149		SER_WRONG_ACTION
14A		SER_NO_HARDWARE
14B		SER_ERR_RESET_FIFO
14C		SER_ERRORCODE_EXISTS
160		ERROR_PO_INIT_READORDER_FAILED
161		ERROR_PO_INCORRECT_DATA_OR_HEADER_SIZE
162		ERROR_PO_EEPROM_IS_FULL
163		ERROR_PO_I2C_WRITE_ORDER
164		ERROR_PO_NO_TIMECLIENT_AVAILABLE
165		ERROR_PO_ORDER_IS_BUSY
166		ERROR_PO_ORDER_IS_FULL
167		ERROR_PO_PRODUCTION_READ_WRONG_TYPE
168		ERROR_PO_EEP1_EEP2_ARE_DIFFERENT
169		ERROR_PO_CRC_EEP1_ERROR
16A		ERROR_PO_CRC_EEP2_ERROR
16B		ERROR_PO_ORDER_HAS_FAILED
16C		ERROR_PO_NOT_AVAILABLE
16D		ERROR_PO_CRC_EEP1_EEP2_ERROR
180		ERROR_I2C_QUEUE_FULL
181		I2C_ERROR_ORDER_NOT_FOUND
182		I2C_ERROR_ORDER_TOO_BIG
183		I2C_ERROR_ORDER_BUSY
184		I2C-Bus : No order in I2C queue
185		I2C-Bus : No active order in I2C queue
186		I2C_ERROR_TOO_MANY_SOP
187		I2C_bad_SDA
188		I2C_bad_SCL
189		I2C_busy
18A		I2C_no_Acknowledge
18B		No Acknowledge from device
18C		I2C_ERROR_NO_ACK_FROM_START
18D		I2C_ERROR_NO_ACK_FROM_STOP
18E		I2C_ERROR_NO_ACK_FROM_SEND1
18F		I2C_ERROR_NO_ACK_FROM_SEND2
190		2C_ERROR_NO_ACK_FROM_RECEIVE

Error ID	Limits	Description
191		ERROR_I2C_SYNCHRONOUS_ORDER_TIMEOUT
192		ERROR_I2C_ASYNCHRONOUS_ORDER_TIMEOUT
193		ERROR_I2C_ORDER_HAS_FAILED
201		ERROR_DS_USER_BREAK
202		Drive system : Timeout during speed up - hand-spin only! speed does not settle after start command
203		ERROR_DS_SPEED_NOT_REACHED
204		Drive system : Speed slows down during measuring - speed falls below limit while measuring
205		Drive system : Wheel speeds up in reverse turn - Hand-spin only! main shaft rotating backwards on start command
206		Drive system : No acceleration during speed up or braking detected 1. Motor 2. Belt mounted? 3. Incremental encoder main shaft
207		Drive system : Slip detected (speed up to fast) 1. Wheel not clamped strong enough 2. no wheel or wheel mass to low
208		Drive system : Speed limit exceeded - speed exceeds security limit (mainly wheel guard open and drive management set to high speed)
210		Drive system : Clamping device got stuck in clamped position
211		Drive system : Clamping device got stuck in unclamped position
212		Drive system : Displacement limit exceeded during (un)clamping
213		Drive system : Belt disc rotates backward after clamping.
214		Drive system : Main shaft rotates during clamping (e.g. EMB defective?)
215		Drive system : Clamp device is locked
216		Drive system : Time limit for clamping process exceeded
300		Motor over-current detected by hardware. Over-current-LED on the power interface board will be cleared on the next activation of the motor
350	0.05 V	First Potentiometer : Voltage below measuring range (AD value : 0..10)
351	4.45 V	First Potentiometer : Voltage above measuring range (AD value : 1014..1024)
360	0.05 V	Second Potentiometer : Voltage below measuring range (AD value : 0..10) 361
361	4.45 V	Second Potentiometer : Voltage above measuring range (AD value : 1014..1024)
370	0.05 V	Third Potentiometer : Voltage below measuring range (AD value : 0..10)
371	4.45 V	Third Potentiometer : Voltage above measuring range (AD value : 1014..1024)
380	4.50 V	ASS : Voltage magnet below limit - off state.
381	1.00 V	ASS : Operating Voltage magnet below limit - on state.
382	2.00 V	ASS : Operating voltage magnet above limit - on state.
383	0.5 s	ASS : Operating Voltage magnet recharging time above limit
400		During measuring run : Data conditioning can't get proper speed information.
401		During measuring run : User break. (Measuring run stopped by user)
402		During measuring run : Temperature information invalid, 20°C used instead.
403		During measuring run : Can't perform transducer correction.
405		Channel 1 - channel 2 Phase shift too big

Error ID	Limits	Description
410		Transducer 1, No signal
411		Transducer 1, transimpedance to low
412		Transducer 1, RC time constant out of range
415		Transducer 1, transimpedance amplifier; idle voltage out of range
416		Transducer 1, DC amplifier; idle voltage out of range
418		Transducer 1, amplifier saturation
419		Transducer 1, Transfer function out of range
420		Transducer 2, No signal
421		Transducer 2, transimpedance to low
422		Transducer 2, RC time constant out of range
425		Transducer 2, transimpedance amplifier; idle voltage out of range
426		Transducer 2, DC amplifier; idle voltage out of range
428		Transducer 2, amplifier saturation
429		Transducer 2, Transfer function out of range
430		Transducer 1&2, No signal
431		Transducer 1&2, transimpedance to low
432		Transducer 1&2, RC time constant out of range
435		Transducer 1&2, transimpedance amplifier; idle voltage out of range
436		Transducer 1&2, DC amplifier; idle voltage out of range
438		Transducer 1&2, amplifier saturation
439		Transducer 1&2, Transfer function out of range
500		BL_BAL_ERROR_NoConverge
501		BL_BAL_ERROR_ResultInvalid
502		BL_BAL_ERROR_TooMuchLoops
510		BL_BAL_ERROR_NoCalUser
511		BL_BAL_ERROR_FailCalUser
512		BL_BAL_ERROR_SideCalUser
		NOTE: C1 = FRONT TRANSDUCER
560		c1 value too low, if a user calibration tool assumed ***C2 = REAR TRANSDUCER***
561		c2 value too low, if a user calibration tool assumed
565		c1 value too low, if a 100g weight and calibration rotor assumed
566		c2 value too low, if a 100g weight and calibration rotor assumed
570		c1 value too high, if a calibration rotor only assumed
571		c2 value too high, if a calibration rotor only assumed
580	-30°C	Temperature below -30°C or hardware fault.
581	100°C	Temperature above 100°C or hardware fault.
585	0.23 V	Temperature Input near to ground Voltage.
586	4.05 V	Temperature Input near to reference Voltage.
601		Internal error : To many event sinks
602		Internal error : Cannot register event sink
603		Internal error : Invalid event level
701		ERROR_IEMS_INV_PARAM
702		Incremental encoder not initialised. Software is not able to detect the reference mark.
703		Incremental encoder : Counter - reference mark mismatch
705	2.50 V	Opto electronic, No voltage on shunt resistor
706	4.30 V	Opto electronic, VCC on shunt resistor
707	16 mA	Opto electronic, Current through LED below limit
708	20 mA	Opto electronic, Current through LED above limit

Error ID	Limits	Description
710		Hand-spin with electromagnetic released brake - main shaft rotates backwards
800	170 V	Line voltage below limit
801	265 V	Line voltage above limit
804	275 V	Line voltage much too high
810	5.10 V	VCC below limit
811	5.35 V	VCC above limit
820	5.00 V	Keyboard/display voltage below limit
821	5.35 V	Keyboard/display voltage above limit
830	4.50 V	External voltage (pedal) below limit, see keyboard module
831		External voltage (pedal) above limit, see keyboard module
900		Power fail detected
9FF		ERROR_SELFTEST
e01		ASA: Status of an activated order has changed due to network manager or shop management software activities.

H CODES SYSTEM IV

H#	Internal code(s)	Description
H0		Wheel running conditions cannot be improved by optimisation
H1		Further optimisation not recommended but feasible
H2		Weight minimisation is recommended, optimisation can achieve no further improvement
H20		The correction plane cannot be re-located using the gauge arm
H21		Indexing position does not match correction plane
H22	0x492215	Unclamping of power clamp device is disabled
H26		The gauge arm was pulled out too quickly (normal operation, ASS calibration)
H28		NEW : The gauge arm was pulled out too slowly (ASS calibration)
H80	0x810510	No provision was made for readjustment
H82		Self test disturbed during execution
H90	0x492203	- Acceleration during start or stop too slow - Measuring speed not reached
H91	0x492204	Speed variations during measuring run

E CODES SYSTEM IV

E#	Internal code(s)	Description
E1		Rim dimensions entered incorrectly
E2		Wheel guard is not closed
E3		Gauge arm not in home position
E4		Outer gauge arm not in home position
E5		Range of electrical unbalance compensation exceeded (residual adapter unbalance)
E6	0x812560, 0x812561, 0x812565, 0x812566	Calibration weight not attached to flange
E7		No balancing mode for this wheel type
E8		Valve position was not entered
E9		Optimisation was carried out incorrectly

E	Internal code(s)	Description
E10		Wheel guard is not open, wheel may not be clamped / unclamped
E12	Not available to date	Pedal is operated, measuring run not possible
E13	Not available to date	The clearance of the solenoid brake is too wide.
E14		The power clamping device is not clamped
E15		Corrective terms for readjustment are out of range
E16	0x812570, 0x812571	Calibration weight attached erroneously to flange
E17	0x492207	Wheel slipped on adapter
E28	0x492205	Wrong direction of rotation (hand spin)
E29		Speed too high (hand spin ?)
E83		Vibration of the machine disturbed the unbalance measurement
E85		Power clamp service interval expired
E88	0x492208	The rotating speed of the main shaft exceeds the safety limit
E89		Key contact or pedal switch closed
E92	0x441350, 0x441351, 0x441360, 0x441361	The inner gauge arm for distance and rim diameter is defective
E93	0x441370, 0x441371	The outer gauge arm for rim width is defective
E101	0xC30E01	ASA: Status of an activeted order has changed due to network manager or shop management software activities.
E141	0x000169	Check sum of EEPROM 1 is wrong
E144	0x00016D	Check sums of both EEPROMs are wrong
E145	0x000168	Contents of the EEPROMs are different
E341	0x00016A	Check sum of EEPROM 2 is wrong
E812		The drive pulley was not readjusted by 180º relative to the main shaft
E900		No model selected
E901		Machine not calibrated
E990		Internal error (message server : message buffer overflow(1)) Machine halts.
E991		Internal error (message buffer overflow(2)) Machine halts.
E992		Internal error (synchronous receive time-out) Machine halts.

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